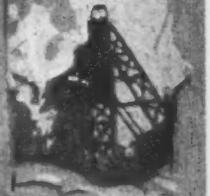
The MINING CONGRESS JOURNAL

Volume 13 OCTOBER, 1927 *No.* 10



IN THIS ISSUE

The Five Day Week
The Public Domain—Resources, Control and Use
The Case For the Hydraulic Mining Industry

Pumping Acid Mine Water
The Hurley Mill, Water Supply and Power Plant
Mining Methods at Chino Copper Mines
Mining Methods of Hanover Bessemer Company

Rock Dusting at Gallup American Coal Company
A Mechanical Loading System with Entryloader
Coal Washing—Some Factors
Storage Battery Haulage

Reports on Mechanization Survey

Contributors:

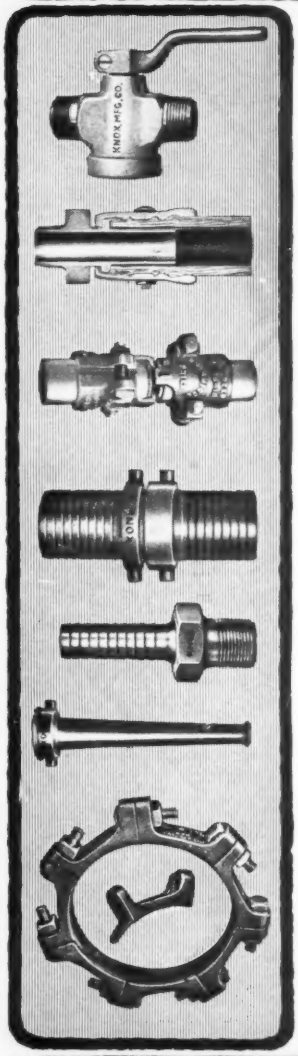
Edward C. Finney, Harry L. Englebright, Horace Moses, L. M. Kuhns, James R. Campbell, W. R. Youmans, C. C. Greenwood, J. T. Shimmin, H. A. Thorne, L. M. Kniffin, G. B. Southward.

KNOX

Valves-Couplings-Nipples-Clamps-Menders

MINING SPECIALTIES

The World's Standard



Those

Closely Watching

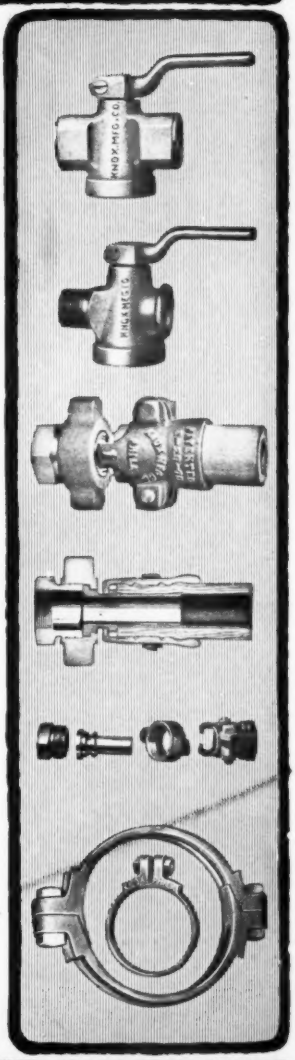
Costs

Specify

KNOX

Valves and

Couplings



KNOX MANUFACTURING CO.

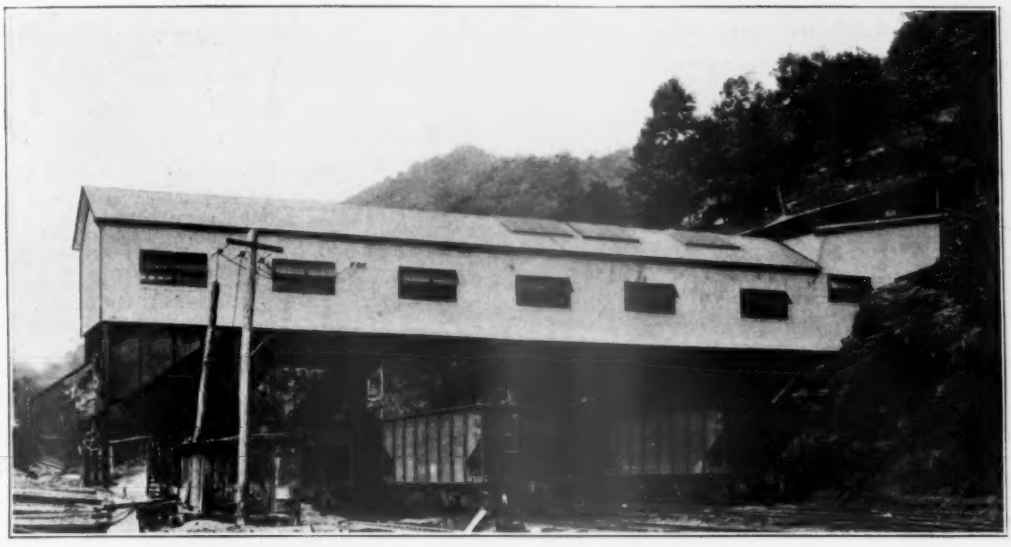
INCORPORATED 1911

817 Cherry St. Philadelphia, Pa.

Competition Is Calling For Better Preparation

Out of 53 contracts (Jan. 1 to date) 32 have been for new plants to replace old ones

THE PLANT ILLUSTRATED BELOW REPLACES ONE BUILT IN 1913



Marcus Tipple built for Melcroft Coal Company, Coxton, Kentucky

A RECORD BREAKING ACHIEVEMENT

Better preparation means an edge on competition, better prices. A new tipple was needed immediately, without any interruption to production. Under those conditions we accepted the contract for the above tipple (Marcus)—to be built in 120 DAYS.

It was finished and accepted in 119 days from the date that the contract was signed. The change from the old tipple to the new was made without a hitch and without interruption to the mine's operation—important with market conditions as they have existed this year.

The new tipple is of the latest Marcus design and replaces an old Marcus tipple built by us for the same company in 1913.

Write us for full information on the most recent developments in the cleaning, sizing and handling of coal.

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85%

of our 1926 contracts were repeat orders—from satisfied customers.

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THE MINING CONGRESS JOURNAL

OCTOBER, 1927

CONTENTS

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EDITORIALS

Unwise Discrimination 747
Alaska—The Land of Opportunity 747
Business and the Extra Session 748
Mechanization to the Fore 748
Our Public Land Policy 749
Labor Day Conservatism 749
Government Control of Oil 750
Bituminous Coal Situation 750

FEATURE ARTICLES

The Five-Day Week 751
The Public Domain—Its Resources, Control and Use—By Edward C. Finney 753
The Case for the Hydraulic Mining Industry—By Harry L. Englebright 756
Reports on the Mechanization Survey—By G. B. Southward 759
Rock Dusting as Practiced By Gallup American Coal Company—By Horace Moses and L. M. Kuhns 764
A Mechanical Loading System With An Entryloader Application 767
Coal Washing—Some Factors in the Problem—By James R. Campbell 770
Storage Battery Haulage—By W. R. Youmans 775
Pumping Acid Mine Water—By C. C. Greenwood 776
The Hurley Mill, Water Supply and Power Plant—By J. T. Shimmin 779
Mining Methods at the Chino Copper Mines—By H. A. Thorne 783
Mining Methods of the Hanover Bessemer Company—By L. M. Kniffin 785

DEPARTMENTS

REPORTS ON THE MECHANIZATION SURVEY 759
PRACTICAL OPERATING MEN'S DEPARTMENT, COAL 764
PRACTICAL OPERATING MEN'S DEPARTMENT, METALS 776
NEWS OF THE MINING FIELD 791
WITH THE MANUFACTURERS 804

NEWS

Production of Graphite in 1926 778
International First Aid and Mine Rescue Contest 789
Arizona Chapter Meeting 791
Sliming Extinguishes One United Verde Fire 792
Mineral Separation By Color Values Developed at Michigan College of Mining 793
Northern Idaho Mining Expenditures 794
Mineral Production of United States Shows Substantial Increase 795
Government's Potash Tests Encouraging 796
Production of Gold, Silver, Copper, Lead and Zinc in Washington 796
Pulverized Coal Tests 798
West Virginia's Second Annual Safety Meet 799
Mining Investigations at Carnegie Tech 800
Soap Bubbles Used To Study Gaseous Explosions 802
Methods of Refining Shale Oil Being Studied Following Closing of Experimental Plant 803

PRACTICAL OPERATING MEN'S DEPARTMENT

COAL

Rock Dusting as Practiced By Gallup American Coal Company
A Mechanical Loading System With an Entryloader Application
Coal Washing—Some Factors in the Problem
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METALS

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Published Every Month by the American Mining Congress, Washington, D. C.

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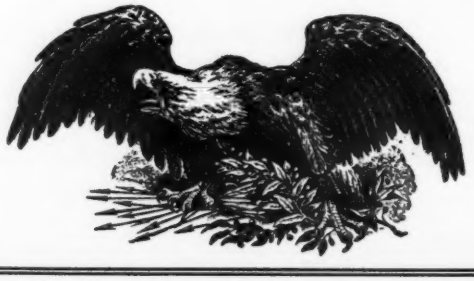

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Entered as Second Class Mail Matter January 30, 1915, at the Post Office at Washington, D. C.

Roger Bacon was thought to be in league with the devil and thrown into prison for his scientific researches which included the development of gunpowder.

Magic— Old and New

A LITTLE less than six hundred years ago, Europe learned of gunpowder. Friar Roger Bacon, the "admirable doctor" of thirteenth-century England, a Franciscan monk who was finally thrown into prison for commerce with Satan, mixed saltpetre, sulphur and charcoal, and made "thunder and lightning" to his own great entertainment and his neighbors' terror. The worthy friar did not put gunpowder to more practical use than magic. It never occurred to him that, confined, the gases from a flash of powder would exert great force that could be applied to many purposes of war and peace. It was not long, however, before someone stripped away the supernatural, and in 1346 firearms are said to have made their appearance, at the battle of Crecy. Equally early, gunpowder must have been applied to blasting purposes.

From this humble and quaint monastic beginning, explosives have steadily increased in use and importance. Chemistry has made one improvement after another. Engineering has found a multiplicity of new uses. Hercoblasting is an example in point.

E. M. Symmes, an explosives chemist of the Hercules Powder Company, devised a new blasting method by which Friar Bacon might have performed real miracles for his gaping contemporaries. It is called Hercoblasting. And it consists of column-loading black blasting powder of special granulation in well-drill holes and firing with Cordeau-Bickford detonating fuse. Where this method is applicable, it has accomplished remarkable results at great savings.

Hercoblasting is only one of the new methods at the command of the explosives engineer. In the list of booklets on the right you will find a wealth of up-to-date, practical information that will be of value to you. Check the ones you want and mail the coupon. They are free.

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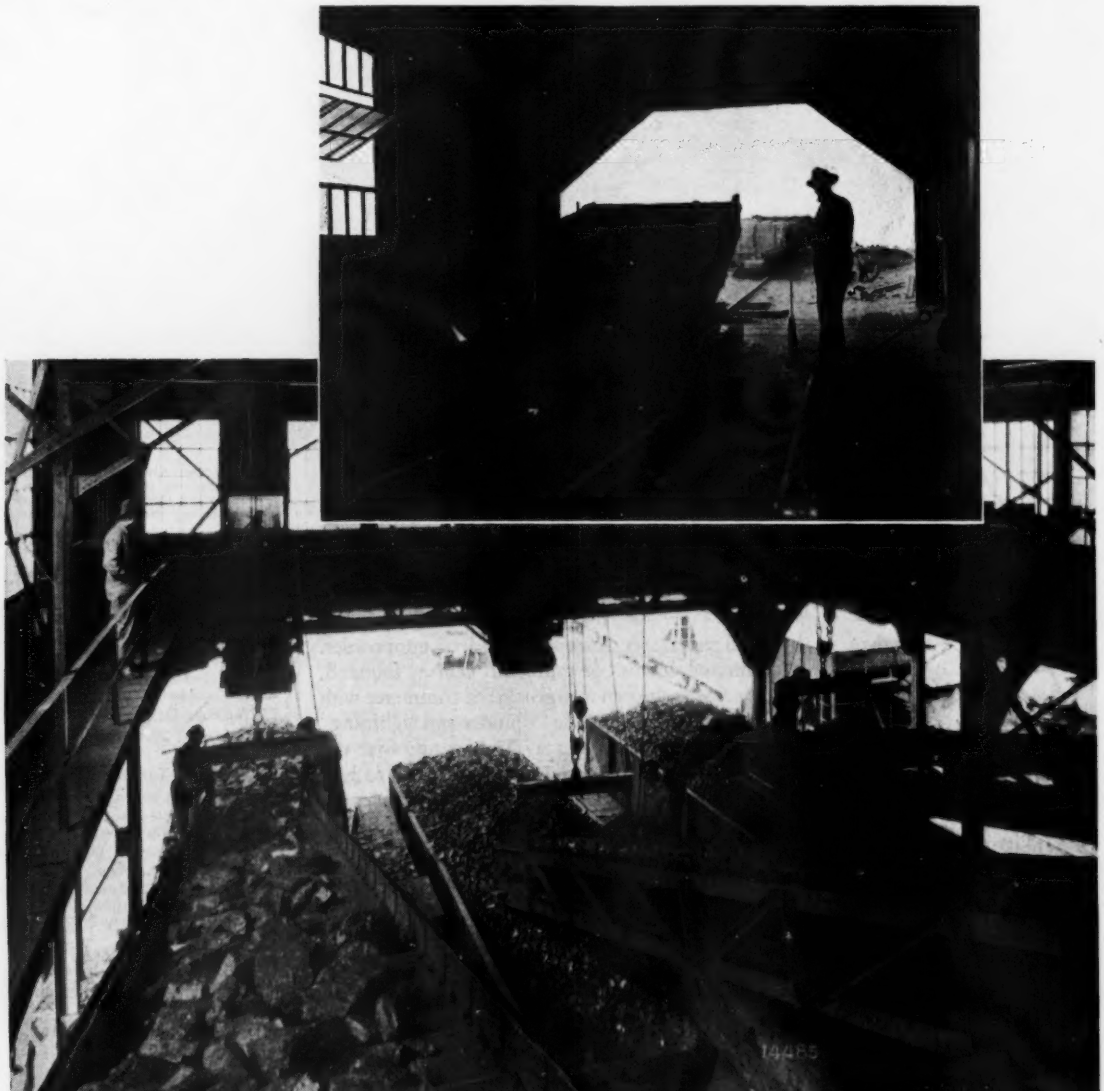

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Buyers know that correctly handled coal will have the least slack or shale. Such coal is delivered from Jeffrey-built tipples.

The Jeffrey all-steel three-boom tipple of the Premier Pocahontas Coal Co. at Premier, West Virginia, delivers all the commercial grades of coal and mixtures at any time.

The photograph shows that the coal is remarkably clean and accurately graded.

The slack is removed ahead of the picking table so that the refuse is easily seen and taken out. After the sizing a rescreening just ahead of the loading booms takes out the incidental fines.

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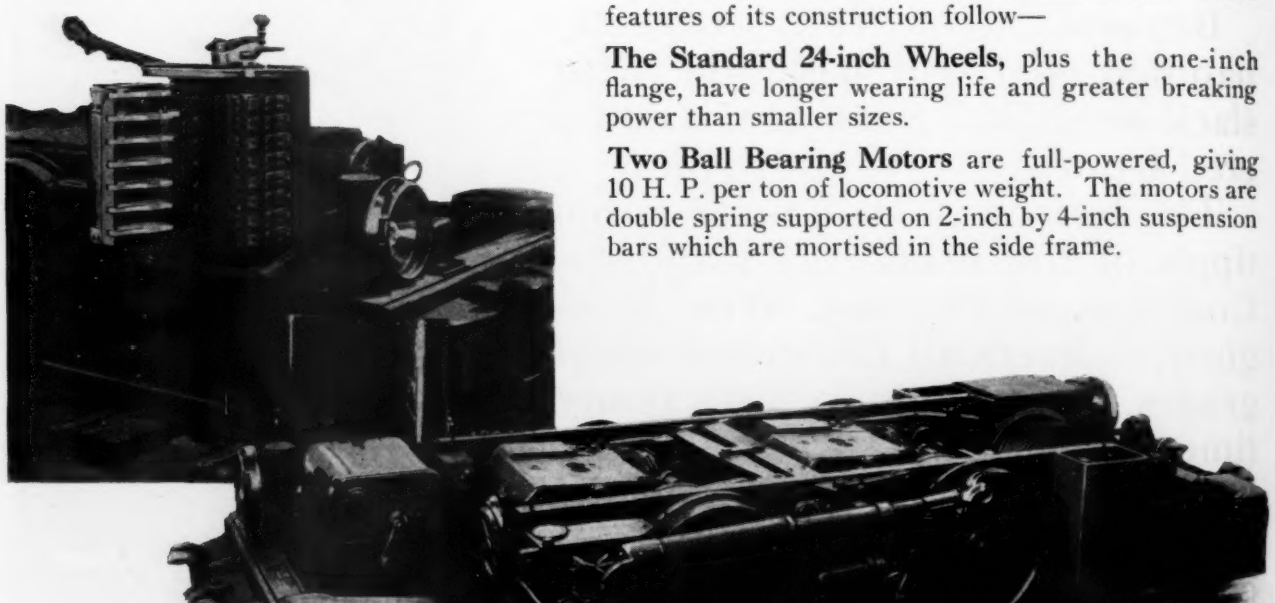
COAL MINE EQUIPMENT

A Low Type Locomotive with –
STANDARD CONS T

25 in. High Over All



THIS Jeffrey 25-inch low-vein gathering locomotive is the most compact in design of full powered locomotives driven on standard wheels. Some features of its construction follow—

The Standard 24-inch Wheels, plus the one-inch flange, have longer wearing life and greater breaking power than smaller sizes.

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Throughout

Heavy Duty 37 Controller is of standard construction having two 5/8-inch wide fingers in parallel throughout. There is a full inch-and-a-quarter line contact on each point of both the operating drum and reverse drum.

Four Spring Supported Journal Boxes give the same easy riding qualities found in larger locomotives. The long helical springs supported in deep pockets in the journal box on either side and below the center of the axle give not only ample resilience but avoid teetering and binding of the journal box in its guides.

Standard Jeffrey 15-A Headlight.

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Standard Cable Reel.

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Widest Motorman's Cab on any outside wheel low-vein locomotive. A cushion seat on the steel floor plate provides the motorman a comfortable and safe position even when operating under extremely low roof.

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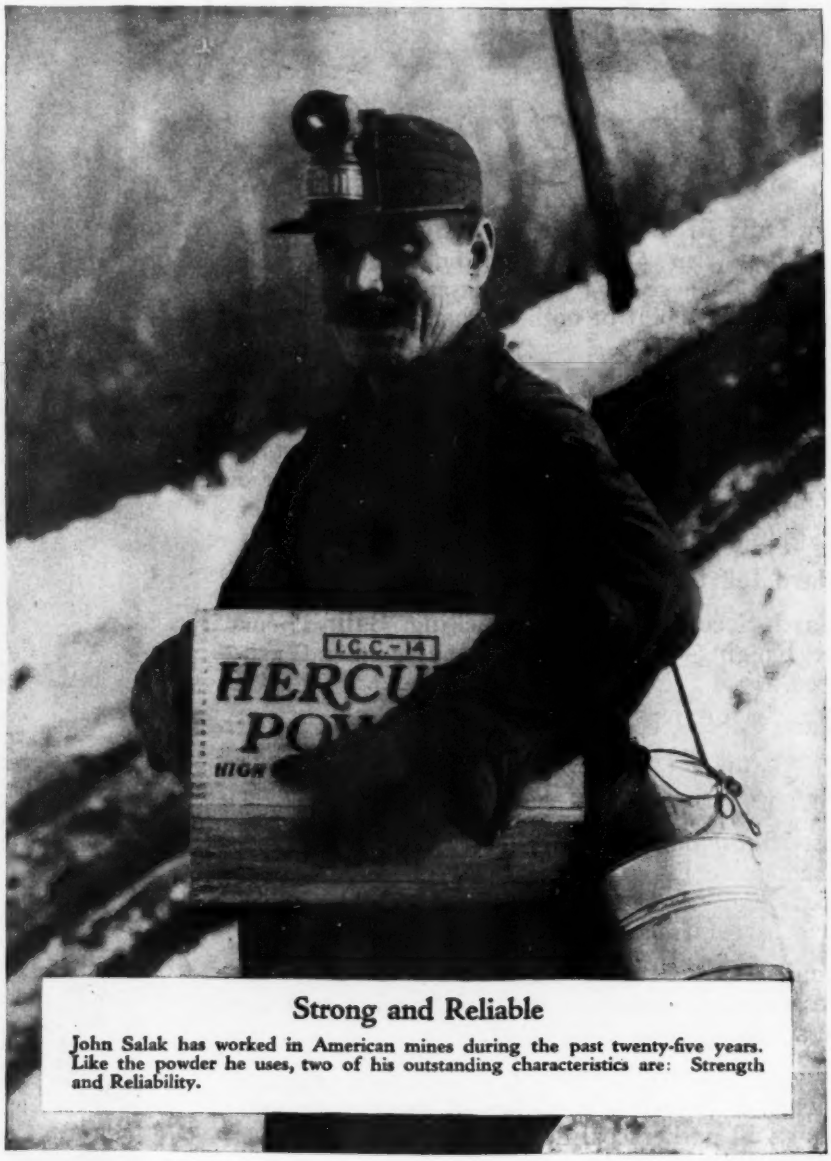
Hercules Blasting Machine, 1 to 50-cap capacity.

Hercules Extra L.F. is adapted for general all-around work. It is one of the economical ammonia dynamites.

Herco-Blasting Powder, used in Hercoblasting, the blasting method consisting of firing black powder column-loaded in well drill holes, with Cordeau-Bickford.



Strong and Reliable

John Salak has worked in American mines during the past twenty-five years. Like the powder he uses, two of his outstanding characteristics are: Strength and Reliability.

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TO PREVENT MIS-FIRES AND WEAK BLASTS

UP to a certain point the detonator is to a blast what the spark is to a motor. If the spark fails or is weak, the finest motor is useless or inefficient. When a detonator misses or is weak there is a missed shot or an ineffective one.

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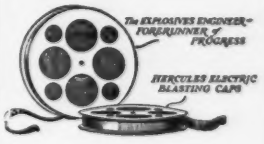

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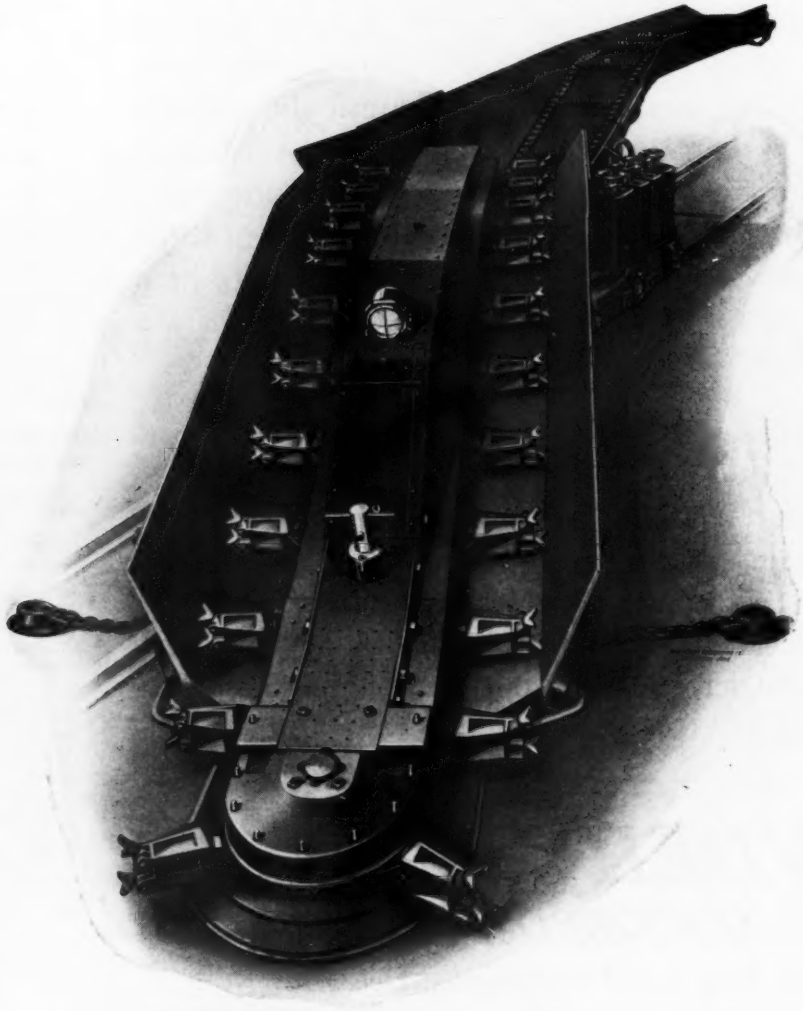

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Costs of coal production are too high. Means are available to reduce them.

Your man day tonnage, if you load coal by hand, is too low. The primary index of mine cost in any field is man day tonnage, irrespective of wage rates.

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COLODERS stay on the track and they stay on the job, too.

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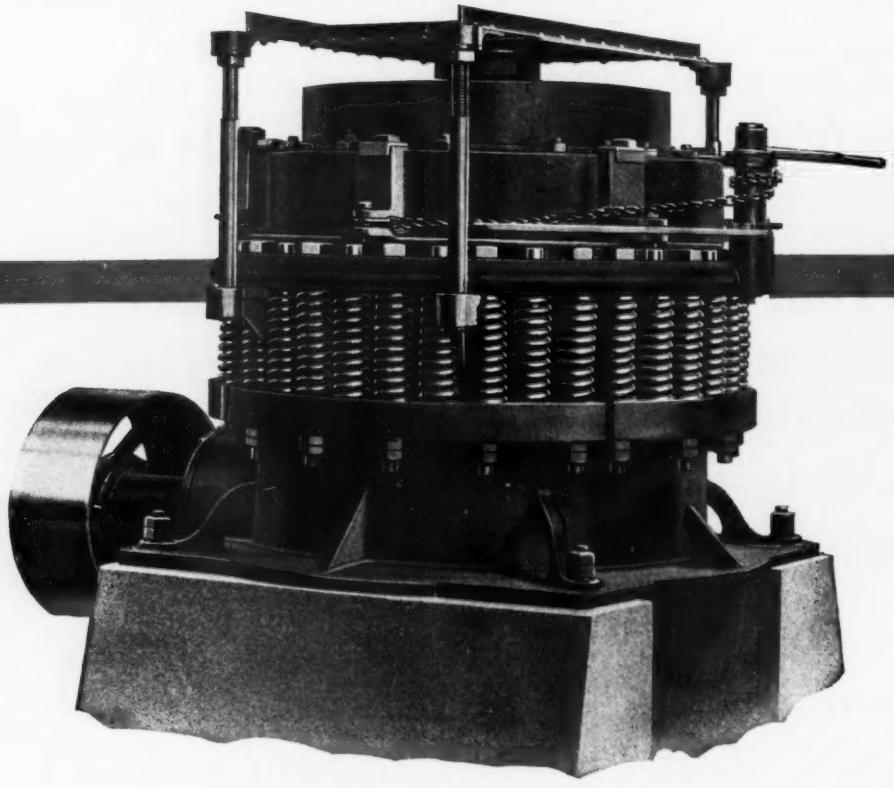
an intermediate crusher



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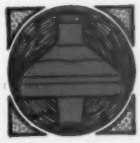
The Symons Cone Crusher

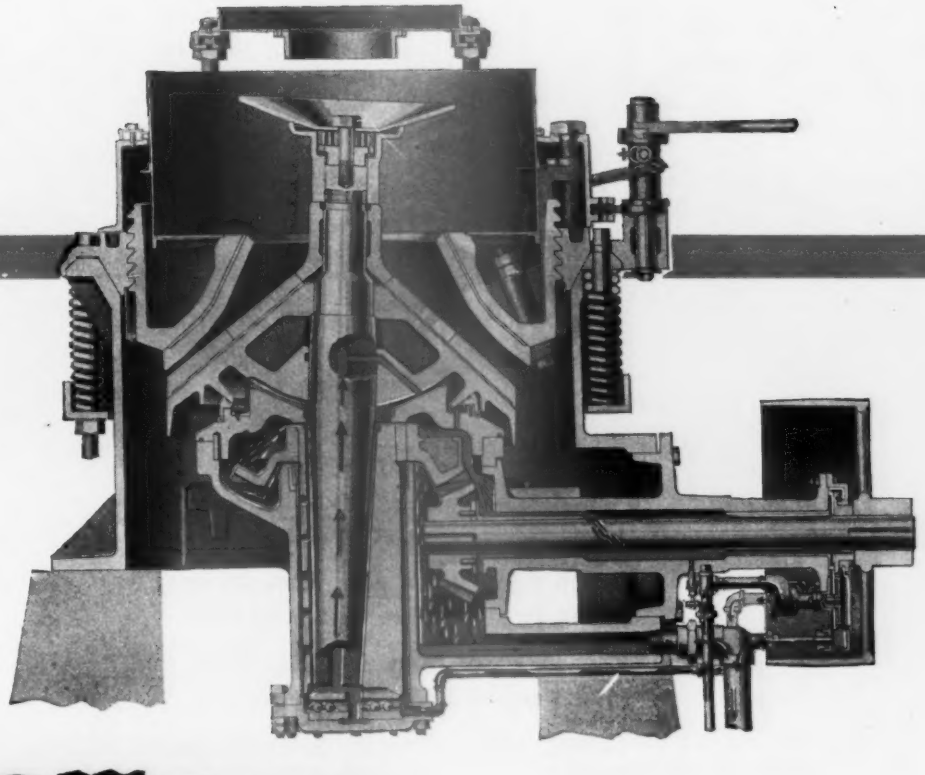
- **Steel, Bronze, and Manganese construction.**
- **Spring protection against tramp iron and steel.**
- **Can be adjusted for different size product while crushing.**
- **Crushes with a wet or dry process.**
- **Manganese parts do not wear bell-shape or in grooves.**

— built in five sizes —

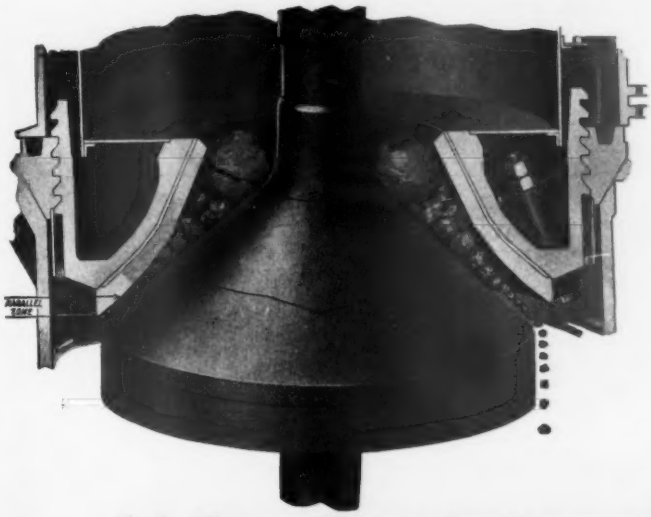
SYMONS BROTHERS COMPANY

—with a capacity





All bearings automatically lubricated



The shape of the outer bowl and long gyration of the conical head allow timing against gravity.

The closed side of the crusher regulates the maximum size of the product.

[★] If a uniform size is wanted for rod or ball mill feed or leaching——write for catalog.

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This is only one of their many outstanding advantages.

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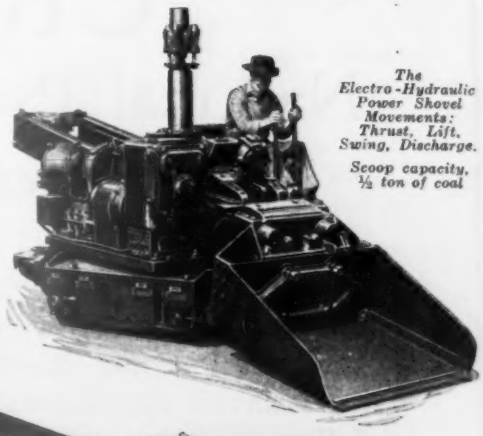
"To Load Coal Mechanically

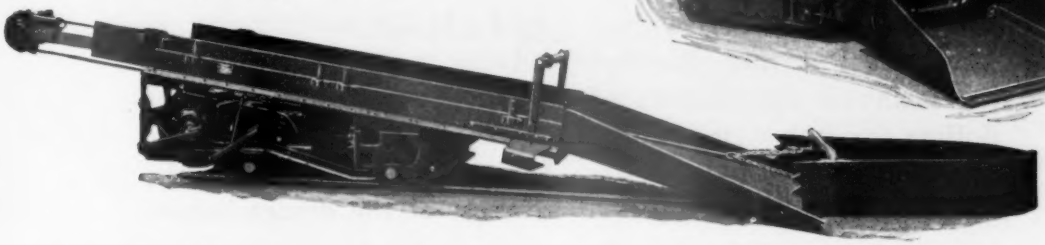
is not simply a matter of purchasing equipment.

"MECHANICAL LOADING calls for advance thought and study. With proper and intelligent approach to each problem, success may be had with a minimum expenditure of money and time."

(Not quoted from one man, but representing the heart of a significant fact stressed by ALL of the operators who prepared and read papers on Mechanical Loading at the American Mining Congress in Cincinnati last May.)



The Electro-Hydraulic Power Shovel Movements: Thrust, Lift, Swing, Discharge. Scoop capacity, ½ ton of coal



The 3-Drum Entryloader—25 and 35 hp. Scoop capacity, 1,500 lbs.; Rope speed 300 ft. per min. Only the scraper goes to the face. A self-contained self-propelling unit.

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The 3-Drum Hoist (125 hp.) which operates the 3-ton Scraper

It will pay you to talk over your conditions with a GOODMAN Loader Man!

(69)

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Unit of Union Carbide and Carbon Corporation

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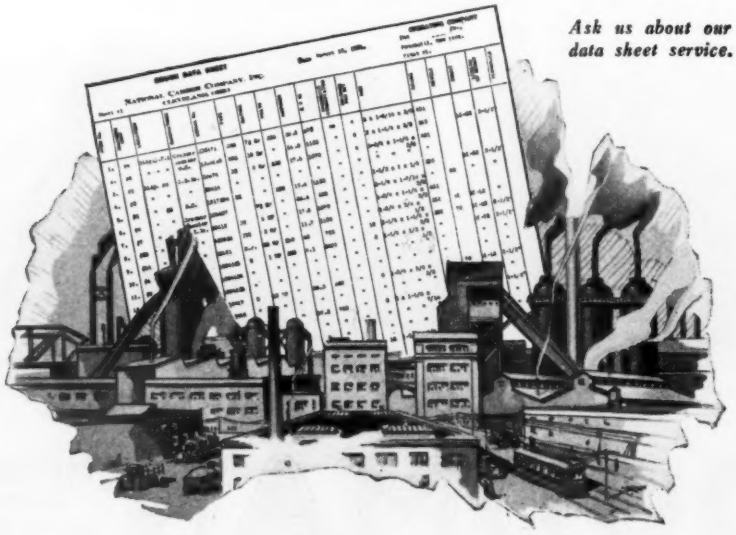

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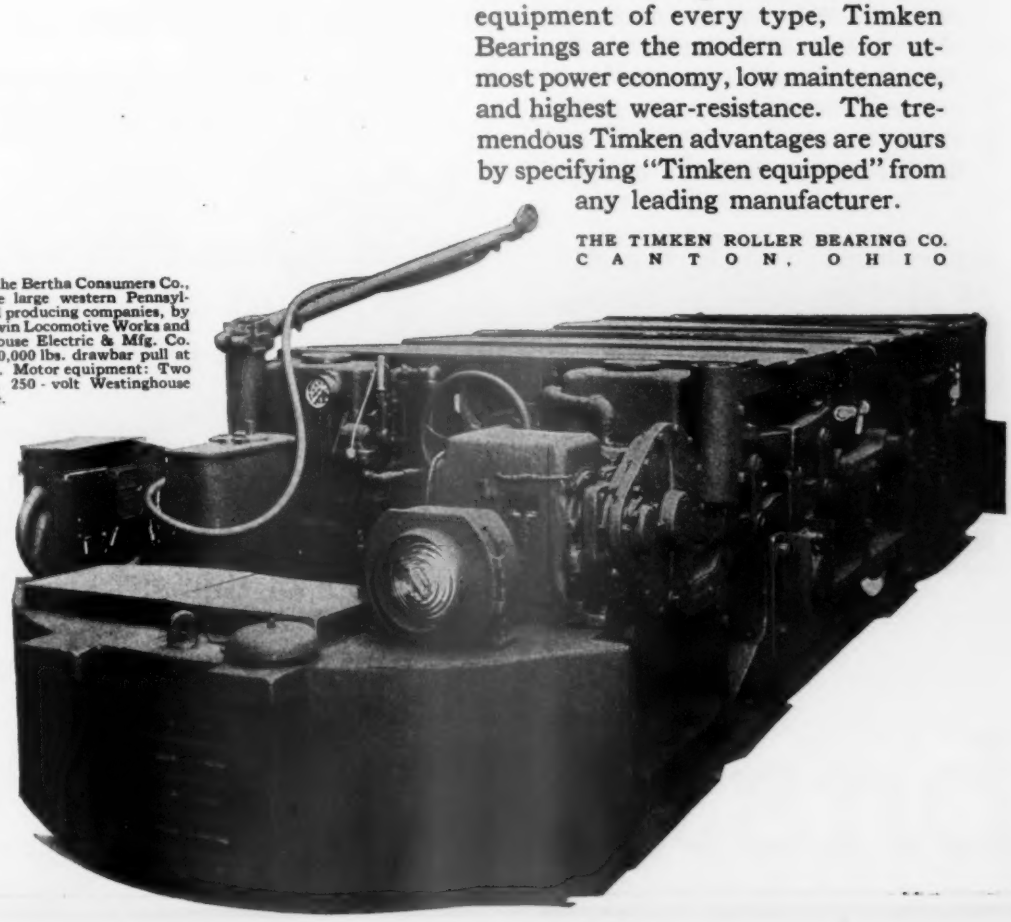

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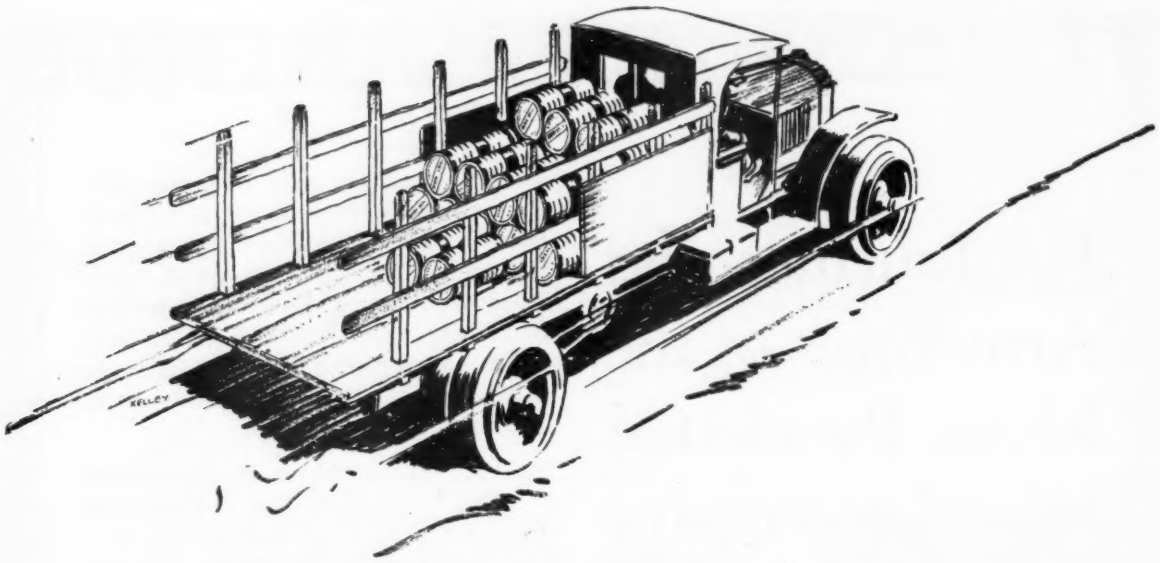

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This drill, which is designed to meet extremely severe conditions, is simple in design, rugged in construction, and easy to operate.

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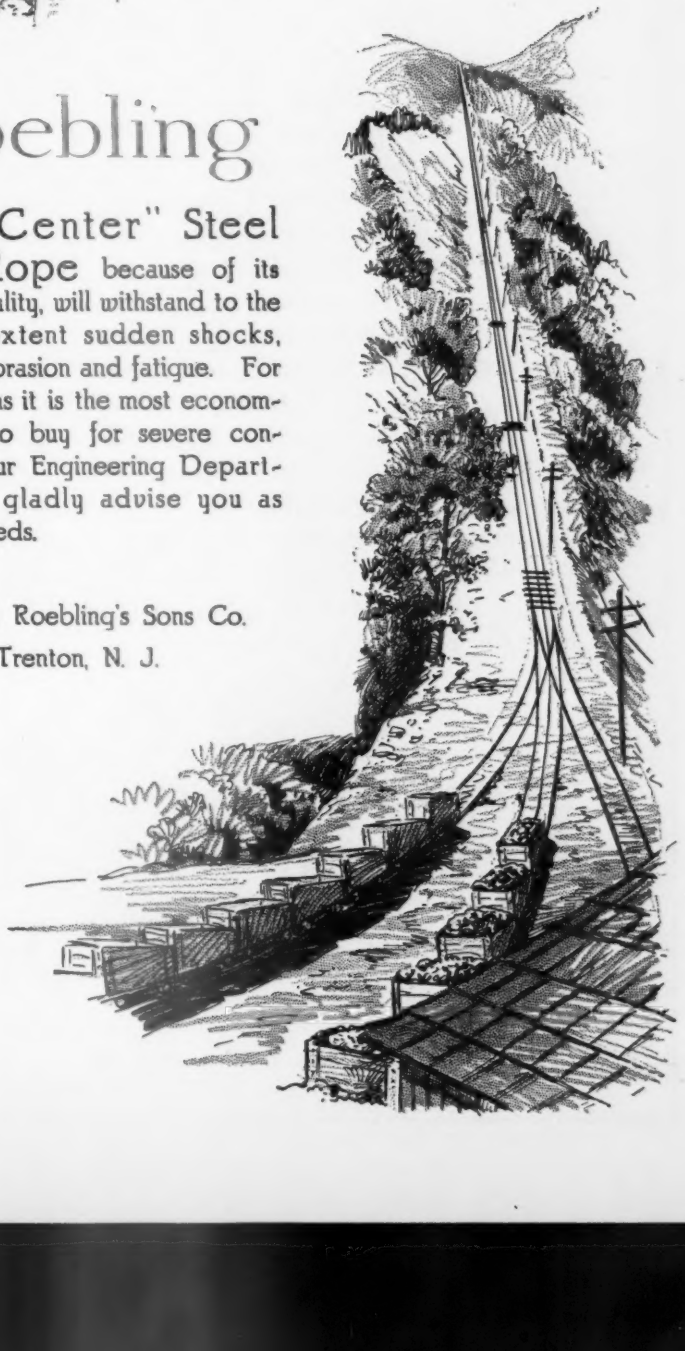

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MANY users testify that Enterprise Mine Cars provide the lowest cost per ton for coal transportation. Here is one concrete illustration.

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- Less cost for repairs.
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- Less friction in operation
- Less grease for lubrication
- Less cars required on account of greater carrying capacity

A combination of economy features we do not believe can be found in any other mine car or truck. We have cataloged the experiences of a number of users and have backed up our every statement with scientific proof in a very interesting booklet that is absolutely unlike any other machinery catalog. It is a mine of information to every coal operator and if it cost five dollars you would certainly own one. It is just as valuable, however, if it does cost you only the price of a postage stamp. The edition is limited, write for a copy today.

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WHEEL AND CAR CORPORATION

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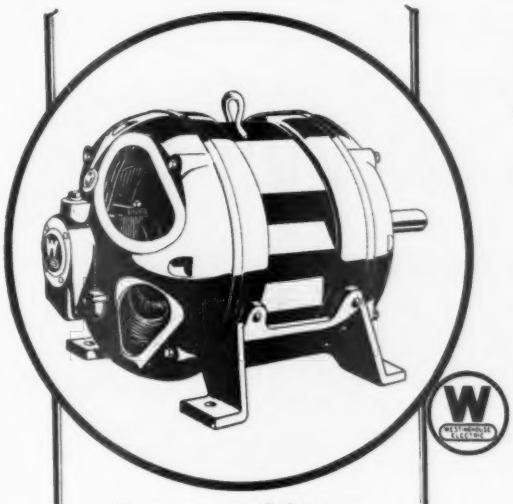

Latest Addition
to the
Westinghouse
Group of
Squirrel Cage
Motors *for*
Starting Directly
Across the Line

Announcing
The
LINESTART MOTORS

WESTINGHOUSE has seen the need for simpler motor equipment for industrial drives—equipment that retains all the desirable characteristics of the squirrel cage motor and at the same time reduces the initial cost of installation. The result was the LINESTART Motor with the following outstanding features:

Simplicity

These motors can be started directly across the line, which means a simple and economical installation.

Torques

Supplied with either a starting torque which compares with the standard squirrel cage motor, or with a starting torque of two to two and one-quarter times full load torque.

Sealed Sleeve Bearings

Equipped with Sealed Sleeve bearings, these motors assure consistent performance under all conditions. So effectively has this bearing been sealed that oil cannot escape and reach the windings, nor can dust or grit get into the bearing.

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The windings are given a double impregnation which not only retains their flexibility, but makes them moisture-resisting and proof against abrasive dust and dirt.

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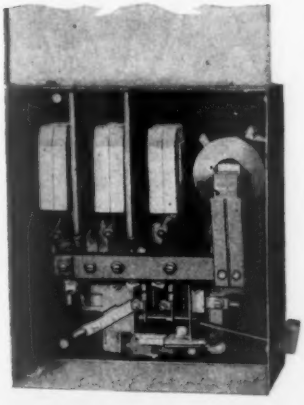

The Westinghouse Linestarter

Simple and Dependable

Just push the button and the Linestarter functions, the motor starts and the machine is in operation.

Protects the Motor

When a sustained overload occurs, the thermostatic metal trips the relay, thereby preventing damage to the motor.

Long Life

Even though the motor is started and stopped hundreds of times a day, the magnetic blowout ruptures the arc so quickly that burning and wear of the contacts takes place very slowly.

Easy to Install and Inspect

The starter comes to you complete and with no internal connections to make. It can be mounted in out-of-way places and every part is readily accessible.

Economical Combination

The Linestarter and Linestart Motor provide a simple, efficient and economical combination for industrial drives.

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Our Lubricating Engineers Can Help You

EVERY operator of industrial machinery realizes the need of proper lubrication. He knows that only through the proper application of the right lubricants can his machinery function at peak efficiency.

Because of the highly specialized equipment employed today, many factors necessarily must be considered when selecting the oil or grease which will correctly lubricate each machine. The operating speed of each unit, the temperatures developed and the load carried must be given due consideration.

Realizing this, the Standard Oil Company (Indiana) spared no expense in developing and perfecting a line of oils and greases that would exactly satisfy the lubrication requirements of every type of machine used by industry. In its line of

Standard Oils and Greases

will be found lubricants of such quality and characteristics that, if used for the purpose for which they are specifically intended, will allow every bearing and moving part to function with greatest efficiency.

To aid in the selection of the right grades of Standard Oils and Greases which will exactly satisfy the needs of each type of machine, and thus decrease operating costs, this company offers middle-west industries the services of its trained Lubricating Engineers.

Upon request, one of these men will visit your plant, and at no cost to you make a complete survey of your equipment and lubricating system. He will point the way to more efficient operation through a report containing his recommendations of the proper application of the right kinds of lubricants for your use.

To avail yourself of this service does not obligate you, and you are free to follow the suggestions as you see fit. We will welcome an opportunity to render you this service. Just phone or write our nearest branch office.

STANDARD OIL COMPANY
(Indiana)

910 South Michigan Avenue Chicago, Illinois

Where Corrosion threatens, *Byers Pipe protects*

Few people understand how costly it is to make pipe replacements.

In an offhand, general way, it may be natural to assume that something like half the cost of a pipe installation goes into the pipe itself and half into labor and incidentals. This is far from correct. In fact, the mere cost of pipe is something like 6% of the total if ordinary pipe is used, or about 10% where Byers Pipe is used.

In other words, whether you put in the cheapest pipe or the best, ninety per cent of your cost will be the same. But if you have to replace the pipe, you will pay a second time, not only for pipe but for all the elements that entered in the first place, and VERY MUCH MORE BESIDES.

To replace $100 worth of pipe will cost from $1,000 to $2,000, depending on the character of the service. Damage by escaping water, steam, or what not, destruction of walls or floors to get at the hidden fault, shut downs of the plant—idle time of machinery and workmen—all this may enter into the account. Power houses, factories, sky scrapers, hotels—taking all uses together, underground and above ground,—from ten to twenty times the cost of mere pipe must be allowed for pipe replacement.

IN mines, factories, power plants, sky scrapers, homes—underground or above ground—replacements are costly.

BYERS, while adding less than 10% to the cost of an installation, will double its years of usefulness.

Cost of Pipe (Threaded) 5.6%
Fittings, Valves, Fixtures, Radiation, etc. 48.5%
Supervision, Overhead and Miscellaneous 18.4%
Labor of Installing 19.7%
Extra Cost of Byers 1.6%
Extra Life Of Whole System Insured By Using Byers Pipe
100%

the *Spiral Stripe*
protects you against mistakes and substitution

Wherever the cost of material is low and the cost of working and applying it is high, the best of such material can be well afforded. For durability in the material prolongs the usefulness of the result as a whole. This is almost an axiom.

The principle holds as well for a pipe system as for a suit of clothes. If the material falls to pieces, expensive work has been wasted. Of all the materials that go into a building, few, if any, are so costly to replace in case of failure. The diagram here shown sums up the facts.

This chart represents many months of cost studies in all types of building. The conclusion is everywhere unavoidable. Pipe replacements are so costly that a small added expenditure to prevent them is manifestly wise.

What is 'Byers 'Pipe?

For pipe, as for other uses where metal must defy corrosion, wise engineers put their trust in wrought iron. A time tested and time honored material it is, filling the practical mind with admiration and satisfying the sense of what is venerable—honest old fashioned stuff with all its native slags and fluxes in their due proportion, and with enduring virtues as long familiar as the anvil and the forge.

Of such material is Byers Pipe. For sixty years the Byers Company have been the foremost producers of genuine, high-quality, wrought iron pipe. At no time have the Byers standards been compromised for the sake of cheapness, whatever the competition. To the same unchanging standards the company is still committed. You are safe when you rest your confidence on the Pipe with the Spiral Stripe.

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BYERS PIPE
GENUINE WROUGHT IRON

The MINING CONGRESS JOURNAL

PUBLISHED EACH MONTH BY THE AMERICAN MINING CONGRESS MUNSEY BLDG., WASHINGTON, D. C.

Subscription Rate: Per Year, $3.00 Single Copies: $0.30

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VOLUME 13 OCTOBER, 1927 NUMBER 10

UNWISE DISCRIMINATION

THE MINING INDUSTRY has two representatives in the Government—the Bureau of Mines and the Geological Survey. Both these agencies have done many things of great benefit to the industry they represent. Yet each has been subjected to the most drastic criticism from mine operators.

For many years, the Geological Survey was the sole representative of mining in the Federal Government. But through the activities of The American Mining Congress the Bureau of Mines was created in 1907 as the industry's own special agency. Its primary function was mine safety and, under the direction of the late Doctor Holmes, the first Director of the Bureau, eminently satisfactory results were achieved along this line. Accidents were decreased in the first ten-year period of the Bureau's existence from 6.78 men per million tons of coal produced to 3.77, and the efforts of the Bureau have never slackened, although they have been hampered because of lack of funds.

The early appropriations for the Bureau were meager, and were mostly expended in the conducting of the safety-first campaign, which centered quite largely around the coal-mining industry. Thus it came in for criticism from the metal operator as being the representative of the coal-mining industry.

As appropriations were increased, the Bureau extended its activities, and with a special appropriation established mine-experiment stations in many sections of the West and South. These experiment stations have made valuable contributions to the science of mining and have more than justified their establishment.

During the early years of the Bureau's existence it was alternately berated and blest. During the last ten-year period the entire mining industry has been apathetic, if not antagonistic. As one operator put it: "We look at the communications from the Bureau and Survey solely for the purpose of ascertaining compulsory regulations." The Geological Survey has fared little better than the Bureau. It has been accused of meddling, of undue slowness in getting information out, and of being somewhat of a nuisance. Operators became impatient with Government red tape as applied by its two representatives, and became thoroughly apathetic as to their success.

We frankly admit that we have not approved all of the activities of these two agencies. We have felt that they have developed a decided tendency to duplication of the other fellow's effort, and a tendency to branch out into fields that were far removed from their proper functions.

But this is not a treatise on the shortcomings of the Bureau of Mines and Geological Survey. Admittedly they have them, but their value to the industry far outweighs any objectionable quality. The Bureau and the Survey belong to the mines of the country. If they have failed to function as the industry desires, it is wholly the fault of the industry itself.

That the metals industry is awakening to this fact is evidenced by a resolution adopted at the annual meeting of the Western Division of The American Mining Congress. It deplores the action of the Bureau of the Budget in curtailing the appropriations of the Bureau of Mines and the Survey. It urges the mining industry to awaken to the fact that it is being discriminated against and to carry its protest to such tribunals as will remedy the situation.

At least this is an important sign. Western mining has discovered its loss in the curtailed work of these agencies, and that is the first step in a widespread appreciation of the truly important functions of the Bureau and Survey.

We agree with the general tenor of the resolution. The Bureau and Survey do need increased funds. But not for the purpose of inaugurating new activities or extending their more or less unimportant functions. The safety work of the Bureau should be extended; its work at the experimental stations should be broadened; the Survey should be given sufficient funds to carry on efficiently topographic mapping, its statistical work, and purely scientific research. Both these agencies need increased funds to enable them to pay commensurate salaries to their scientists, who for the most part are men of real ability, who can little afford to give their services for the stipend allowed on the Bureau's budget.

If mine operators feel that the Bureau and Survey are not functioning properly, they need only make their protest audible, intelligible, and militant. Both these agencies exist solely for the benefit of mining. It is their function to be helpful. Carping about a situation does not remedy it. Let us get at the root of the trouble and make our Federal representatives truly representative of the mining industry in every sense, eliminating those things that make for trouble, and fostering those things that bring cooperation.

ALASKA—THE LAND OF OPPORTUNITY

SENATOR FRANK B. WILLIS, upon his return to the States from an extended trip through Alaska, stated that the people should be encouraged to go to Alaska, "invest their money, develop the country, and make homes for happy and prosperous people."

The Senator's advice, while interesting, is somewhat belated. Perhaps he may recall that the people did just that thing—"go to Alaska, develop the country, and invest their money," and that for their trouble and pains many were branded as criminals, their property confiscated, their investment lost, and the country's resources tied up in litigation for years.

For those hardy pioneers who braved the hardships of a new country there was nothing but political condemnation; the resources they attempted to develop were heralded as monstrous holdings; they were politely called thieves; and under a guise of conservation for future generations Alaska's marvelous mineral resources have been held undeveloped, its facilities to handle even its present limited commerce completely paralyzed, its farms abandoned, its mines forsaken. With Alaska in the hands of the bureaucrats its population decreased with startling rapidity, until today in the whole of that vast territory there are but 35,000 white inhabitants.

It may be recalled that the Guggenheim interests in the early days of Alaska went into that virgin territory, built railroads, developed mines, and started communities. The great cry went up from the politicians that the "interests were gobbling up Alaska," when, as a matter of fact, they controlled only about half the territory or mineral resources that are owned, controlled and operated in the United States today by the Consolidation Coal Company.

It is not too late to develop Alaska. But before this can be done it is essential that she be freed from bureau control, that she be eliminated as a proving ground for those who believe in "Government ownership of natural resources."

The Alaskan Railroad, constructed at such an enormous cost to the people of this country, it is frankly admitted could have been built for considerably less, and with approximately half the time expended, by private capital. This is true of all Government competition with private enterprise. History has never shown that any enterprise conducted by disinterested parties, such as must be the case of Government employes, has been successful except at a tremendous cost to the people. Alaska is no exception. She has cost this Government a great deal, not alone in actual money but in inability of the Government to develop and utilize her resources.

Alaska is everything the Senator says it is. It is a pity that more Senators do not make the same trip as did Mr. Willis, who went "as a private citizen." It is quite possible that if they had done so Alaska would not be today the bureau-ridden, red-tape infested, Government ownership experimental wilderness it is.

BUSINESS AND THE EXTRA SESSION

THE NEW YORK WORLD has been loudly demanding an extra session of Congress. In a recent editorial it went so far as to indicate that such help would save a tottering nation, and pointed out that "if business in the United States is now so delicately balanced that it totters when the country's own National Legislature meets, then both business and the United States are in a much worse state than anybody guessed, and it is time to call for help."

Such a statement is, of course, amusing, and indicates just how little reason even *The World* could find for the calling of a special session of Congress. The country's lack of enthusiasm for special sessions is not confined to this particular one; we even fear that the regular sessions of Congress are beginning to be looked upon with dread.

Ostensibly flood control was to have been the major reason for calling Congress together. But how long would the discussion have been confined to this subject? We venture to predict not more than twenty-four hours. The opportunity to make capital for the presidential campaign next year would have been irresistible; and all those members of Congress who have pet schemes for the saving of the industrial life of the Nation could scarcely have refrained from telling us about them. In a very short time after the assemblage of such a special session business would have been seriously engaged in the famous old battle of threat and dodge, and many a political finger would have been sunk into the industrial pie.

Business of this country has been unduly harassed for a period of more than ten years. The interesting political game of meddle and muddle in its affairs has gone merrily on. Some of this harassing has been necessary, due to changes from war conditions, changes from one form of political government to another and the attendant readjustments. But the continuous flood of bureaucratic officiousness, meddlesome regulation, unwise taxation, and threatened confiscatory legislation have left industry weary and drastically opposed to any and all sessions of our National Legislature, except solely for the disposition of routine business.

Business isn't tottering. But it is entitled to a respite. President Coolidge's decision against an extra session will meet the complete approval of the mining industry. Odds against it were at least a thousand to one.

MECHANIZATION TO THE FORE

THE MECHANIZATION SURVEY that has been under way by The American Mining Congress since January, 1927, is developing some highly interesting facts. Attention has already been directed through these columns to the progress being made by the successful installations now in operation and the variety of conditions under which mechanized mining is being used. The number of successful installations are increasing and the present indications are that the time will soon arrive, if it is not already here, when the competition with mechanically mined coal will be felt in all bituminous fields of the United States.

The word "competition" when used in speaking of coal mining is usually referring to production cost or selling price and we are using it here in this same sense. However, production costs are the direct result of several coordinated factors and competition between hand loading and mechanical mining is actually a competition between a number of basic and fundamental methods of operation. Physical labor is competing with machine production; the intelligence required to perform muscular work is competing against the trained intelligence required to direct or operate a mechanical device; loosely coordinated individual effort is competing with the efficiency of a closely supervised systematic operating unit. In such a competition which side has the best chance to win? The same which has always won in the past.

While the underlying principles of mechanization are as old as industry itself, the application to coal mining is new and the bituminous mines are now learning how to apply these principles. Mechanization is destined to play a great part in the future history of the coal mining industry. In fact it is entirely possible that the next few years may decide which mines will continue to operate and which will be definitely closed, and present indications are that mechanization will be an important factor in this decision. It is therefore of vital interest to every coal operator to keep in touch with this development.

Our mechanization reports are showing this development and including the October issue, sixteen individual reports have now been published. These publications will continue during the course of the next six months and each one will show a successful operation personally visited by G. B. Southward, Mechanization Engineer of The American Mining Congress. While this investigation was begun nearly a year ago, the reports are brought strictly up to date before publication.

OUR PUBLIC LAND POLICY

HALF A CENTURY AGO exponents of Government ownership, the single tax, and other radical theories of government, decried the Nation's policy under which the public domain was passing to private ownership. The homestead and mining laws, the railroad land grants, and every measure designed to populate, upbuild, and promote the western territories, were opposed and deplored by the radicals of that day because of what they termed "the evil effects of making the land of a whole people the exclusive property of some." But the Government's liberal policy was continued and the western territories became states.

But during the last decade there has been a marked change in that policy. The leasing system has been established as an important part of the general scheme of public land administration and disposition. Coal deposits, oil lands, and power sites on the public domain must be leased in order to be developed and utilized; and the Federal Government has become a tithe-collecting landlord at the expense of the public-land states which would derive benefits in the form of taxation revenue if the public lands passed to private ownership.

The enlarged homestead acts have interfered with mineral prospecting. Once a homesteader gains control of 640 acres of surface, the prospector no longer has free access to the land to prospect for the minerals that are reserved to the United States. The discovery of a single important mineral deposit would be worth more to the Nation that several townships or even counties of 640-acre homesteads; yet, by giving away control of the surface, the Federal Government has stifled prospecting and perhaps has lost important minerals that otherwise might have been discovered. Therefore, either the desert-land homesteader should be encouraged to prospect his land for minerals by promise of ownership in case of discovery, or restrictions that hold back the prospector should be removed.

Where the present policy of Government landlordism and leasing or its extension will lead ultimately can not be foreseen. Undoubtedly, Government ownership of power sites, coal mines, and oil wells on the public domain has potential influence that might be used to control industries dependent upon these resources for power and fuel. It is certain also that the leasing system already is depriving the public land states of taxation revenue. How far will the states allow the Federal Government to go without protest?

The best public-land policy is that which insures the greatest development and utilization, without waste, of the natural resources of the public domain. The liberal policy of the past, which encouraged prospecting, mine and power development, and reclamation, has produced evidence of its soundness in the great agricultural, mineral and power resources, and transportation systems, that have been developed with private capital and under private management and ownership. May that policy be shaped to meet present conditions, and continued; and further innovations and extensions of Government landlordism and leasing be rejected. Private ownership and taxes are preferable to Federal landlordism and tithes.

LABOR DAY CONSERVATISM

THE WALL STREET JOURNAL in a very able editorial on the Labor Day utterances of the president of the American Federation of Labor says: "Labor Day manifestoes of the aim and thought of unionism in this country were pitched in a comparatively new key of amity toward society as it is, * * * . In a word, the wage worker is becoming more conservative in the best meaning of the term, as more and more he has something worth conserving."

President Green, while holding tenaciously to many of the old positions of his organization, such as collective bargaining, voluntary arbitration, shorter hours, and the living wage, further explained labor's understanding of the needs of industry as "mutuality, understanding, and respect for the rights of each other."

We are in accord with that understanding of a sound foundation for industrial relations, but as the representative of an industry that comes into direct contact with the principles that actuate the labor unions, we are inclined to believe that this much desired platform has not been adopted by Mr. Green's entire family; certainly it is not in evidence in the dealings of the bituminous coal industry with the United Mine Workers.

The mines of the bituminous coal industry that have for years cooperated with the union in its "collective bargaining, shorter hour, living wage" program, now find themselves in the deepest distress because the union refuses to recognize the principle so well expressed by the Federation of "mutuality, understanding and *respect for the rights of others.*" The union miners are losing thousands of dollars daily, and our coal production, on which our national prosperity depends, is seriously curtailed. Capital is unproductive, and whole communities have been deprived of the industrial support that means their continuance. Certainly this situation can hardly be described as "something worth conserving" by either the public, the coal operator, or the organized miners themselves.

We do not mean to indicate that all the virtue in such controversies in the mining industry is on the side of the operator. But it is obvious that with hundreds of thousands of dollars tied up in unproductivity, with markets continually being lost to competitors, with equipment deteriorating, with business, so far as the union-operated mines are concerned, at a standstill, that the operator and the miner will welcome any reasonable way out.

It is vastly important that this enlightenment, which has been voiced by the leaders of the labor movement, shall filter down through the ranks; that glittering generalities, no matter how pretty, be followed by dependable action. It should also be remembered that only one-fifth of the labor of this country is represented by the labor unions; that the other four-fifths are dealing with their respective employers on a basis that is apparently satisfactory; and that some such principles as those which characterize the Federation's Labor Day manifesto must become the root of the labor movement in each of its separate industrial channels.

The United Mine Workers of America would do well to heed the wisdom of the words of Mr. Green.

GOVERNMENT CONTROL OF OIL

THE RECENT ADDRESS of Secretary of the Interior Work before the American Bar Association, while sounding reasonable enough to the uninitiated, would, if the suggestions therein were carried out, open the door to Government control of minerals. No one denies the need of the oil industry, or the coal industry, or the silver industry, or the gold industry, for a Moses. But not even the most unthinking man in any of these branches of our great mining industry believe that that Moses should be the government.

Secretary Work refers to the possibility of self-regulation within the oil industry, and suggests that voluntary measures might produce the desired result of conserving oil in the ground. The uninformed might infer from this that the oil industry is not doing its duty, either in relation to its own business or the public interest. He suggests that if the remedy rests with the oil companies through "voluntary and wholehearted cooperation," the time is ripe for action. But surely he knows that any such voluntary procedure as would be effective is successfully stopped by the provisions of the Sherman Anti-Trust Law. The oil industry has no cooperative producing and marketing act under which to establish unit pool production or unit marketing arrangements.

It has also been suggested that a committee from the oil industry draft a conservation bill to be laid before the next Congress. Secretary Work is chairman of the Federal Oil Conservation Board, and as such has been engaged in a study of the oil situation for more than a year. Mr. Work asks the abrogation of the law of supply and demand, and urges the setting up of an arbitrary control of production, saying "the ordinary workings of the economic law of supply and demand find no chance in the business of producing petroleum."

So far as the action suggested to the Bar Association is concerned, it is so circumscribed by constitutional law as to make such an investigation little short of ridiculous. Oil lands that have already passed into the hands of private individuals are not subject to confication by the state without "due process of law." The States can not surrender a control to the Federal Government which they do not possess. The Federal Government has no power whatever to "control oil production" without a change in the Constitution, and as anyone knows changes in the Constitution are not arrived at overnight.

The Secretary's suggestion that Government representatives, oil producers, and skilled lawyers form a committee is wiser, but the further suggestion that their investigation be made the basis of legislation can lead only to trouble unless such legislation be modification of the Sherman Law.

Why further investigation? The Government created the Federal Oil Conservation Board. It made an exhaustive survey of the situation, and, after careful deliberation, the only suggestion it made was to let the oil industry alone.

It is always a little surprising that the politician feels he can immediately settle by legislation the problems that the finest brains in the country are struggling with. American business, somehow, so far has been able to adjust itself to rash restrictions and arbitrary regulations promulgated largely for political expediency. The threat of confiscation, the club of legislation, is continually held over the heads of the owners of natural resources. It is no wonder that their decisions have sometimes been unwise.

Neither the oil industry, the coal industry, nor any other industry needs the Government as a benevolent father. They need friendly cooperation, understanding, and, especially, a hands-off policy whenever economic conditions require such measures as curtailment of production and consolidations of operators to prevent wasteful exploitation of reserves. This means just one thing—the modification of the Anti-Trust Law.

BITUMINOUS COAL SITUATION

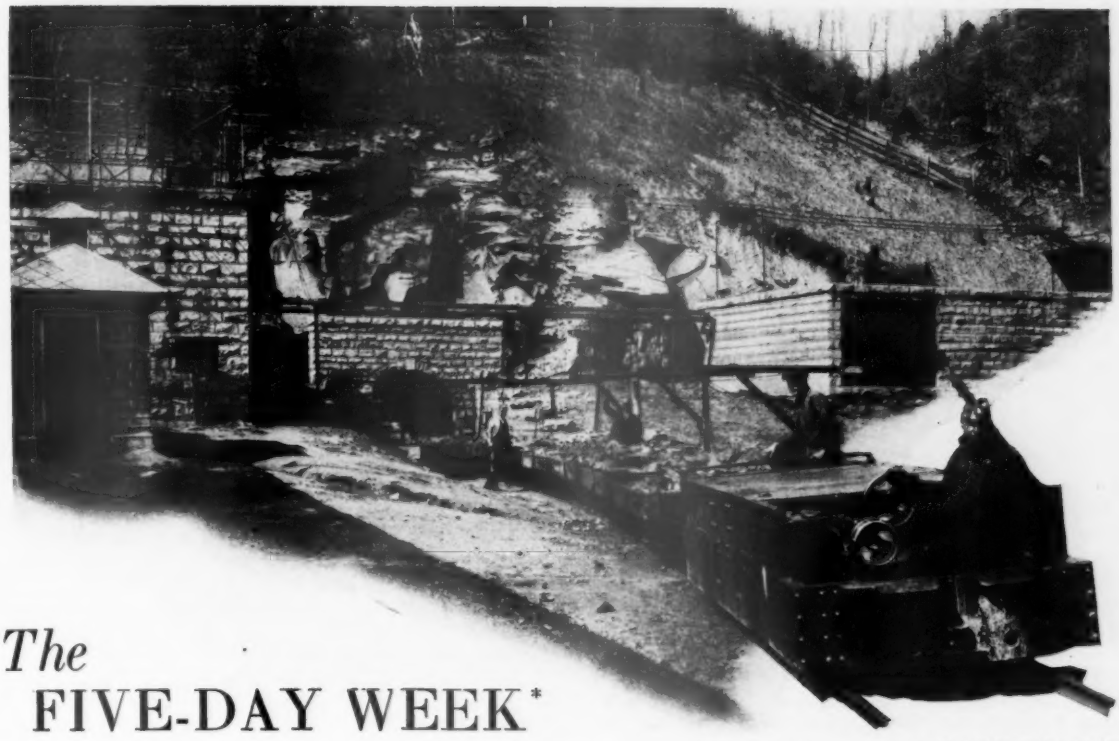
THE BITUMINOUS COAL INDUSTRY, through the stand-pat attitude of those fields tied up by the strike and by the increasing production capacity of the non-union fields, is winning the greatest labor battle in its history. The fighting is not over, but victory seems sufficiently near at hand to anticipate peace in all the soft coal fields within the reasonably near future. The strike is now in its sixth month, with production steadily mounting and with stocks remaining not seriously depleted. Former union mines that have reopened on an open-shop basis are increasing production. The Pittsburgh Coal Company's August production was the greatest of any August since 1923, and it is certain that the Pittsburgh district will absolutely refuse to yield to the Mine Workers' demands. The same is true of the Ohio field, where mines are resuming operations on the open-shop plan. Indiana and Illinois at their recent conference refused to accept any plan that even temporarily forced upon them the acceptance of the Jacksonville scale.

It is, of course, difficult for the layman to understand just what is back of the policy of the United Mine Workers, which has kept some 175,000 men out on strike for approximately six months. Why should the leaders of the labor union force this idleness upon their workers in an effort to force Illinois, Indiana, Ohio, and Western Pennsylvania to pay the Jacksonville wage agreement, when the needs of the Nation are being adequately supplied by other coal-producing states operating on an open-shop scale?

It is equally mysterious to the layman why the operators should refuse to accept the demands of the unions, when millions of capital are lying idle; properties closed down, with the attendant deterioration of equipment and the inevitable loss of markets.

So far as the policy of the United Mine Workers is concerned, it is apparent, as it has been for many years, that an ambition for power is their controlling motive. Rather than lose prestige by advocating a wage reduction, they have deliberately misled the idle miners as to the ability of the operators to pay the Jacksonville scale. The leaders in the labor movement will doubtless continue in their present policy as long as they have it in their power to control their membership without consulting the desires of the workers themselves.

In the present struggle the coal operators have had the support of the public and the press. In this respect it has differed from previous strikes. The public has been enlightened and is no longer confused as to the issues involved. A makeshift settlement or temporary peace on the basis of the union demands would be a grave mistake, and it would mean the loss of public sympathy and support to a very large degree.



The FIVE-DAY WEEK*

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Opinion Overwhelmingly Opposed To It—Agriculture Considers It Impossible—Only In Cases Of Overproduction Is It Considered Economically Feasible—This Industrial Question Not A Field For Legislation Or Regulation

PROBABLY no industrial question in recent years has so stirred the country as Mr. Ford's suggestion of the five-day week. The National Association of Manufacturers and many employer-groups, after conference and discussion, have indicated their opposition. Proponents of the plan believe that efficiency would be maintained and production costs lowered. Opponents maintain that unit production costs would be raised, and the general burden inevitably passed on to the consumer.

The August issue of THE MINING CONGRESS JOURNAL carried the results of a nation-wide questionnaire on problems of current interest, of which the five-day week was one. It may be recalled that 66 percent of the total replies were opposed to the five-day week in any form for any phase of industry. Nineteen percent were in favor of its adoption as an American standard, 2 percent believed it might be applicable in a number of cases, but never as a national principle, while 13 percent had no opinion in the matter.

The rapid growth and application of power in American industry is unquestionably at the bottom of the movement, which crystallizes itself in the phrase "a higher standard of living." That such a standard is already the privilege of the American workman is an accepted truism. Many of the respondents to the questionnaire expressed the feeling that there is a tendency today to "coddle" the worker more than is necessary. A prominent banker states:

"The great trouble today is that labor leaders have taught their men to give as little as possible, and obtain the highest compensation therefor. The result is that in many vocations, workmen do not render 33 percent efficiency in connection with their work, and at the same time they are being paid higher wages than ever before. For many centuries men have worked six days in the week, and no previous generation has ever felt the need of the five-day week."

It might be pointed out that working hours per day have also been shortened in most industries and that in the present era of mechanical appliances, much of the drudgery of production has been eliminated, while in all the larger manufacturing states, factory inspection and regulations have created vastly improved conditions of labor.

As manufacturing is today more and more carried on by automatic machinery, the hours of operation of the machinery and not the hours worked by the employes, measure the rate of production. Shortening the week, it is pointed out, must inevitably reduce production and increase costs.

A national manufacturer states that "Too much leisure is a bad thing for anybody. Truly 'Satan finds mischief for idle hands to do.'"

An entirely novel viewpoint is that in a majority of trades the individuals will work the sixth day for an added wage so that the five-day week is in reality an attempt to secure higher wages.

In plants where furnaces and similar equipment must be maintained at a high heat, they must, to operate efficiently, be run continuously. If these furnaces were to be closed down two days a week, the cost of operation would be increased at least 25 percent.

The farmer and wool grower are alarmed at the possibility of a five-day week, because if it prevailed in other industries it would attract labor and increase production cost, which would either add a burden to the consumer, or add more difficulties to the problems of livestock raising and agriculture. Like the blast furnace in its continuous operation, weeds grow and crops mature seven days a week.

A clothing manufacturer voices the opinion that only after both the foreign and the domestic demand for American

* This article is the third of a series of five, prepared from information gathered by the Bureau of Mining Economics of The American Mining Congress, on five major national questions.

goods reaches a level of fair stability can a shortening of the hours of production be contemplated.

One point about which much argument revolves, is the question of over-production and under-consumption. It may be said that two days of leisure per week will increase consumption along many lines, while on the other hand if a six-day wage is paid for five days, production cost must increase and thus automatically limit the purchasing power of the laborer, or else if he is only paid for five days at the former rate, his own earning capacity has been reduced, and he can no longer afford to purchase as much.

Like the manufacturer referred to above, a wholesale grocer feels that one day a week to rest and refresh one's self has Biblical sanction; more than that would be unwise. "As it is," he continues, "one has ample time after an eight-hour day to rest and divert himself and improve his mind. To add to existing hours of leisure, would only open the doors for an increase of folly, of which the Wise Man said, 'All is Vanity!'"

Another keen student of the situation feels that in certain industries using only skilled workers, the five-day week may prove satisfactory, but he asks, "Who will give employment to the millions of men not efficient enough to fit into such a system? Radical labor is making a hard pull to compel the Government to take care of the masses instead of the people comprising the Government. It is the idle man who gives all the trouble now."

Intensely interesting is the viewpoint of physicians and educators. A physician whose name is familiar on both sides of the world says:

"I am opposed to the five-day week. I believe such a speeding-up effort would not be compensated for by the extra day of rest. The wear and tear on the human organism will undoubtedly be increased, and I believe it basically and physiologically wrong."

A university president adds that it would prove a physical toll that only the very strongest men can stand, and would force out of production a large number of persons who can not keep up the pace.

"Morale of the workers would be lowered, and quality of production would fall" is the opinion of another professor, who quotes the disorganizing effect on the student, of any holiday break in the usual routine.

In a serious effort to find the truth, a railroad president says:

"Leaders of labor unions, generally, have always resisted anything which tended to speed up the production of their members. Apparently they ignored all the economics of the situation and saw only that a smaller output per man meant more men employed, and this greater employment meant a larger and more powerful organization.

"At the same time, leaders of this character have continuously contended for higher wages and shorter working hours for their members. They have calmly ignored the fact that all these elements have a decided effect upon the cost of living and that each increase in unit costs has made necessary further demand for higher wages.

"It is difficult to conceive a more complete vicious circle than exists in this instance. Aside from the economic side, I feel that modern-day society needs work and workers—not more holidays."

Several engineers voice the opinion that Saturday is already considered a poor production day, due to the anticipation of a half-holiday, and that little loss would be entailed, were the entire day given to the worker. They state however, that driving a car (the common form of holiday-spending) for two days is a task that consumes nervous energy, lowers efficiency, and encourages extravagant expenditures.

An architect says that his men are always slow getting into their routine work on Monday morning and that half of Monday is lost before they gather up the impetus of the work. He believes that if any shortening of hours is to be effected, it should be by the day and not by cutting the days per week.

It is frequently cited that countries having constant holidays always drop behind in production; that two days per week would encourage a national spirit of unrest and lawlessness, and that no man is ever quite so happy as when he is required to work hard to make both ends meet.

On the other hand, the proponents of the shorter week maintain that with the additional time for rest, recreation, and intellectual improvement, the incentive to achieve would be greater, and the present standard of efficiency easily sustained.

The economic point is raised that agriculture and distribution both require constant service, and that no matter how well the five-day week may serve strictly manufacturing interests, its introduction would seriously handicap the producer and distributor of food stuffs.

A large national association asks, "If five days per week will increase efficiency and lower production costs, why will not four do so to a greater extent?"

In one particular line, the great department stores of the country, the five-day week seems to have met with special favor, for two months in the year, and many department store heads consider its extension to the full 12 months as certain.

The head of a large stationery house says that modern machinery has made possible such a high rate of production, that we are as a nation overproducing. He believes the first effect of a shortened week would be increased unit cost, but that constant improvement in machinery will reduce these costs in turn. He states that slightly higher prices and steady employment are preferable to over-production and consequent unemployment.

In discussing over-production, however, the economists say that the productivity of the United States is not of such magnitude (with our population increasing by 5,000 a day), as to sustain the people as a whole, on a five-day week basis.

In general, it would seem that each industry must be judged by itself. A machine-industry would have great difficulty in speeding up efficiency to offset the loss in time. Probably some industries might be better off while others could not exist under such an arrangement.

The matter is not a field for legislation or for regulation. The economic merits of each case, and the market for its individual production must be the controlling factors. Certainly it would not appear that the American public as a whole, is in sympathy with or desires the five-day week.

AMERICAN MANAGEMENT ASSOCIATION

The mining and related industries are well represented in a group of 41 leading business executives who have organized an Advisory Board of the American Management Association, feeling that improved management methods are essential in maintaining present prosperity and that knowledge of such methods should be spread more quickly throughout business.

Sam A. Lewisohn, vice-president, Miami Copper Co.; C. F. Dietz, president, Bridgeport Brass Co., and Acheson Smith, president, Acheson Graphite Co., are on the board. A wide range of industries and some of the largest corporations in the country are represented.

Both production and distribution will be included in the scope of the board, which will serve in guiding the policies of the association and in focusing its increased research facilities on pressing industrial problems. Among the fields in which new management methods are now being developed and tested by the association and its members are those of labor efficiency and labor relations, financial control and budgeting, sales research and salesmen's training, office management and personnel administration.

The division of commercial laws of the Department of Commerce is collecting copies of the mining laws of all countries so as to make them available for examination by persons interested in the mining industry.

Photo by W. J. Lubken, Courtesy U. S. Forest Service

Stanton Lake, Flathead National Forest, Montana

THE PUBLIC DOMAIN—ITS RESOURCES, CONTROL AND USE

An Answer To Articles Criticizing Government Public Land Policy—Leasing Principle Upheld —Policy From Legal And Constitutional Viewpoint Sound—Practically All Additions To National Forests Direct Demand Of States Themselves—Vast Mineral Holdings

By EDWARD C. FINNEY*

DISCUSSIONS at conventions of The American Mining Congress have been followed by the publication in THE MINING CONGRESS JOURNAL of various articles discussing Federal domination, so called, and ranging from constitutional questions, involving the entire field to more narrow discussions relating to a single resource, or to specified classes of reservations.

Some articles advocate the cession of all Federal resources, lands, timber, minerals, and national forests and parks to the respective states in which located, while others would retain under Federal control certain of the resources, passing others to private ownership or to the respective states.

"Unconstitutionality," "inequality in treatment of different states," "absentee landlordism" are terms used with relish in certain of the articles. Those who take their stand upon the Constitution start with the proposition that all powers not delegated to the United States by the Constitution, nor prohibited by it to the states, are reserved to the states, respectively, or to the people. They refer to decisions of the Supreme Court holding that the Union is one of states, equal in power, dignity, and authority; that a new state comes into the Union with all the powers of "sovereignty and jurisdiction which pertain to the original states." This is the basis for the argument that the Federal Government has never exercised the power to control or dispose of reserved lands in the original 13 colonies, nor in the State of Texas; that when it undertakes to dispose of, reserve, or use public lands and their resources in other states, the latter are not on terms of equality with those first named.

This argument would seem, if carried to the ultimate, to involve an impossibility. If the states are to be on an absolute equality in every particular, it would be necessary that they be equal in area, equal in resources, equal in population, and have no more individuality than the squares on a checkerboard. Of course, the framers of the Constitution, and the Supreme Court of the United States, in its various decisions, had no such idea in any language that may have been used, either directly or by implication, designed to secure equality in power, dignity, and authority among the several states of the Union.

It would be impossible within the confines of this article to point out all the distinctions and differences between the situation in the original states and Texas and the states later admitted into the Union. That the eastern colonies or states did not insist on reserving to themselves control over and use of the public resources within their original territories is shown by the fact that the Congress of the Confederation, on October 10, 1780, passed a resolution providing for the reception and care of such unappropriated lands as might be ceded by the original colonies to the United States and for their disposition for the common benefit, and that seven of the states made such cessions—New York, Virginia, Massachusetts, Connecticut, South Carolina, North Carolina and Georgia—involving approximately a total area of 259,171,000 acres of land.

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Texas occupied a position different from that of any other state. The Texans fought for and secured their own independence. It was not thereafter a territory or a colony of the United States, but was an independent republic, and when it came into the Union, it did retain ownership and control of its unappropriated public lands. Whether that was for the best interests of Texas—whether it impeded or hastened its development—I will not here undertake to say.

From an equitable standpoint, however, I can not see what claim any of the states, say in the middle or far west, have or could have, as individual states, to the lands ceded by seven of the original states accepted under the resolution of October 10, 1780. Nor can I see what equitable claim they may properly advance to the exclusive ownership and control of lands included within the limits of the Louisiana Purchase, the money for which was contributed, not by the individual states now existing within its boundaries, but by the United States; that is, by all the people of the United States. The same is true of Seward's purchase of Alaska. The southwestern states did not bear the burden of the war and expense which resulted in the acquisition of territory from the Republic of Mexico. The United States bore this burden and the same is true of practically the entire territory of the United States which may be described as the public-land area, and to which the discussion in the articles mentioned applies. This was recognized by the people of the newer states themselves, for every act of Congress admitting a new state into the Union since 1803 (except Texas) has contained a clause somewhat as follows: "The people in said state shall never interfere with the disposal of public lands therein by Congress." They recognized and agreed that these unappropriated lands were the property of the United States, to be controlled and disposed of by the Congress of the United States for the common benefit.

The majority of the pioneers of the West took advantage of the public-land laws to acquire homes and lands through purchase, preemption, homestead, desert-land, and mineral entries, and they accepted the liberal donations made by the Federal Government for the support of schools and other state institutions. They were glad to come into the Federal Union and they did not seek to impose a condition that as a prerequisite to that union they should be presented with the public lands and resources within their borders. They have developed and grown amazingly, despite the alleged evils and wrongs of the policy now criticized by the isolated individuals to whose contributions I have referred.

This growth confirms the prophetic wisdom of Henry Clay, who, when discussing this subject in the United States Senate in 1832, opposed such views as are herein discussed, and illustrated the beneficial effect of Federal control over public lands upon advancement of population and prosperity, citing as an example of the benefits resulting from Federal control, the State of Ohio, as compared with the advancement of his own home state, Kentucky, where the lands were held by the state. He said, among other things, that Ohio was 50 years in advance in internal improvements and certain other respects of her older sister state.

Passing for a moment the question of alleged equities or of benefits or disadvantages, and reverting to the constitutional question, it seems clear to me that that provision of Article IV of the Constitution, which gives to Congress power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States, does not, as contended, require the divestment of all title of the United States to all of said lands and resources at any fixed time. It confers the power of disposal, but the following clause does not, as I construe it, empower Congress to make rules and regulations *only relating to disposal.* It confers the power to make rules and regulations respecting the territory or other property of the United States; that is, whether kept or disposed of, Congress has the constitutional authority to make rules and regulations with respect thereto. This conclusion need not rest upon my opinion, because it has been considered and disposed of by the Supreme Court of the United States in not only one, but many cases.

One hundred and twenty years ago Congress authorized the President to lease lead mines in Indiana Territory for terms not exceeding five years. In the case of *United States* v. *Gratiot, et al.* (14 Pet., 526), it was contended that Congress had no power to authorize leases of public lands and obtain profits from the working of mines; that Congress can not delegate the power to lease public lands. The Supreme Court, in substance, held that power over the public lands is vested in Congress by the Constitution, without limitation; that the words "dispose of" public lands used in the Constitution can not receive any other construction than that Congress *has* power to authorize the leasing of lead mines in the public lands in the territory of the United States. The court further stated that the State of Illinois subsequently created out of part of the territory "can not claim a right to the public lands within her limits. It has been the policy of the Government at all times in disposing of the public lands to reserve the mines for the use of the United States and their real value can not be ascertained without causing them to be explored and worked under proper regulations."

The subject had comparatively recent consideration by the Supreme Court in the case of *Light* v. *United States* (220 U. S., 523). The opinion in this case, to which there was no dissent, was written by Mr. Justice Lamar, an experienced and able lawyer, and a man from a public-land state of the South. Mr. Justice Lamar was not a man to surrender any constitutional rights of a state, nor to overlook the sovereign rights of a state. In his opinion in the Light case, he said:

The nation is the owner and has made Congress the principal agent to dispose of its property. * * * Congress is the body to which is given the power to determine the conditions upon which the public lands shall be disposed of. *Butte City Water Company* v. *Baker* (196 U. S., 126). The Government has with respect to its own lands the rights of an ordinary proprietor to maintain its possession and prosecute trespassers. It may deal with such lands precisely as an ordinary individual may deal with his farming property. It may sell or withhold them from sale (*Camfield* v. *United States*, 167 U. S., 524), and if it may withhold from sale and settlement it may also as an owner object to its property being used for grazing purposes, for the Government is charged with the duty and clothed with the power to protect the public domain from trespass and unlawful appropriation. (*United States* v. *Beede*, 127 U. S. 342.) The United States can prohibit absolutely or fix the terms on which its property may be used. As it can withhold or reserve the land, it can do so indefinitely. (*Stearns* v. *Minnesota*, 179 U. S., 243.) It is true that the United States does not and can not hold property as a monarch may for private or personal purposes (*Van Brocklin* v. *Tennessee*, 117 U. S., 158), but that does not lead to the conclusion that it is without the rights incident to ownership, for the Constitution declares, section 3, Article IV, that "Congress shall have the power to dispose of and make all needful rules and regulations respecting the territory or the property belonging to the United States." The full scope of this paragraph has never been definitely settled. Primarily, at least, it is a grant of power to the United States of control over its property. (*Kansas* v. *Colorado*, 206 U. S., 689.) All the public lands of the Nation are held in trust for the people of the whole country (*United States* v. *Trinidad Coal Co.*, 137 U. S., 160), and it is not for the courts to say how the trust shall be administered. That is for Congress to determine. The courts can not compel it to set aside the lands for settlement, or suffer them to be used for agricultural or grazing purposes; nor interfere, when in the exercise of its discretion Congress establishes a forest reserve for which it decides to be national and public purposes. In the same way and

in the exercise of the same trust it may disestablish a reserve and devote the property to some other national and public purpose. These are rights incident to proprietorship, to say nothing of the powers of the United States as a sovereign over the property belonging to it.

These decisions of the highest court of the land, extending over a period of more than a century, establish the constitutionality of reservations for parks, forest reserves, and other national purposes, and conclusively show that Congress has the power to not only dispose of the public lands and resources, but to withhold them from disposition for the public benefit, and effectually and finally dispose of the contention of one of the articles contributed to your Journal, that the forest reserve act violates the Constitution and is contrary to rulings of the Supreme Court.

So it appears that the public-land policy from 1780 down to the present moment is not only sound from a legal and constitutional viewpoint, but has not discriminated between the states by treating the newer states as unequal in power, dignity, and authority. It has rendered unto Caesar the things that are Caesars. As to matters which are under the control, authority, or in the ownership of the states, California has received exactly the same treatment and has the same power and authority as Virginia. As to the question of advisability of methods of disposition of the public domain and its resources, or as to whether national reservations should be created and maintained, men may differ, but the laws enacted, the acceptance of the opportunities and benefits thereby conferred, the demand for and the interest in national reservations like the parks and forests, clearly indicate to my mind that the people of the United States, east and west, with few exceptions, firmly believe in and favor the present policy.

Some years ago, Congress by law provided that as to certain western states, no additions could be made to national forest reservations except by act of Congress. Numerous additions have been made since that time by Congress and many others proposed, and it is an interesting fact that in practically all instances the bills for additions to existing forests or creation of new ones were introduced and pressed by members of Congress from the states in which the forests were to be created. It is a reasonable assumption that these gentlemen represent the view of at least the majority of the people of their states.

The argument that the existing public-land policy withholds lands and resources from taxation is hardly applicable to those laws which provide for the outright sale and disposition, and presumably relates to permanent reservations or to the leasing policy adopted some years ago. The objectors seem to assume that if public lands, reservations, parks, etc., were ceded to the several states, they would, *eo instanti*, produce taxes and be immediately developed. Of course, this is not the fact. Development of lands and resources requires time, men, money, transportation, and markets. Will all of these come under a policy which seeks to divorce to a degree the several states from the Union and place each in the attitude of a separate unit, with possibly as many different laws governing the use and disposition of the lands and resources as there are states, with a local instead of a national policy, with the narrow view and experience, instead of a broad and national one?

Israel under the control of the judges was an unorganized community of twelve tribes. There was no unity of action, and instead of being all for one and one for all, there was the narrow, selfish view of looking out for me and mine, regardless of the other fellow's troubles. When the Ammonites attacked an outlying province, and the inhabitants made an appeal to their fellow countrymen for relief, the other tribes "wept," but those tears were not effective in relieving from an attack of the enemy. When under Saul, Israel became a united compact nation, the invaders were expelled by united effort.

I am told that in traveling through Europe, one thing that impresses the traveler is the fact that at frequent intervals you reach frontiers and pass in comparatively short distances and times into entirely different atmospheres, languages, customs, habits, and conditions. Americans take pride in the fact that we can travel from the Atlantic to the Pacific, or from Alaska to the Gulf of Mexico, and find people of the same language, same customs, and practically the same conditions of life. This is true of our national policy with respect to public lands and resources. The mining law, for instance, is the same in Florida as it is in California, and is administered in the same way by the same executives. A national forest in California is the same as a national forest in New England or North Carolina. A national park in Arizona has the same general administration and the same general rules and regulations as one in Maine.

Andrew Jackson's inspiring words, "The Federal Union, it must and shall be preserved," may well be applied in spirit to our national resources, which belong to the whole people, pursuant to the Constitution and the laws of the land, and which are theirs to acquire and use, not under the local regulation of a state, in whose conduct and management they have no voice, but under the control of their Federal Government.

It would seem that the critics should realize that this is the spirit and desire of the people from the pride they take in and the use they make of the national parks, national forests, and other national reservations, both east and west. By the millions the people, from every state of the Union, are visiting, using, and enjoying these reservations. In them they feel at home, because they are theirs. They could not feel thus, were they in private or local ownership and management, and this brings me to the thought that those who are opposing the present policy are short-sighted, even from the dollar standpoint.

These millions of visitors to the national parks, forests, and other reservations pass by train or motor through the so-called public-land areas, spending their money as they go for gasoline, food, souvenirs, etc., with the local merchants, creating and sustaining the business of innumerable local communities. Moreover, many of these visitors attracted by the climate, soil, and opportunities remain, acquiring lands and property or making other investments, in this way adding to the population, development, and wealth of those areas.

Railroads fully realize the importance of these Federal attractions on or near their lines, and liberally advertise them. The Federal Government, through its official reports relating to these and all other natural resources, gives information and incidental advertisement that these public-land states could obtain in no other way. Ten million people visited the national forests last year. Two hundred and twenty-five thousand people visited a single national park. Are these reservations a detriment or a benefit to the states in which they are located?

The estimated monetary royalty and sale value of unreserved public lands and resources made by a former Secretary of the Interior approximates $14,000,000,000. The dollar value is not, however, the vital one to the people. The value lies in the kind, quantity, and general public need for the resources. Some of them are: 90,000,000,000 tons of coal in public ownership, outside of Alaska; 700,000,000 barrels of oil; 50,000,000,000 barrels of shale oil; 3,500,000,000 tons of phosphate, and 20,000,000 tons of potash. What these means to present and future generations is difficult to realize; but that these vast quantities of the necessary fuel and fertilizer minerals are under the ownership and control of their Government, to be wisely used and conserved from waste, is of incalculable public value.

Then in- (*Continued on page* 766)

THE CASE FOR THE HYDRAULIC MINING INDUSTRY

Resumption Of Hydraulic Mining In California Means Much To The Nation In Continuing Its Present Prosperity—Estimates From Reliable Sources Indicate Vast Amount Of Gold Recoverable—Legislation Necessary

By HARRY L. ENGLEBRIGHT *

Malakoff Diggings In The Old North Bloomfield Hydraulic Mine, Nevada County, Calif.

GOLD! The very word conjures up the whole drama of human history and the motives that have animated men. Its story is a world-old romance, as yet unfinished. It is not of gold, the symbol, however, that the present writer wishes to speak, but of gold, the yellow metal itself.

This country has been fortunate in having gold mines within its borders in addition to its other enormous resources. To what extent the present unexampled prosperity of the United States is due to the large stock of gold underlying its credit structure no man can say. The metal of itself can not be said to add largely to the national wealth, a mere five billions out of hundreds of billions, but when its power as a currency reserve is considered it must be conceded that the part played by gold in the economic machinery is entirely incalculable. The whole banking system would be paralyzed without it and trade and industry impotent and prostrate.

There has been a surplus of gold in this country—so long a surplus, that is to say, when measured against the holdings of the rest of the world (our total stock of the metal is about 45 percent of the world's total at present) that we have gradually accustomed ourselves to the view that this redundancy is permanent. Clearly such a state of mind is not well founded nor tenable. Nobody can forecast what the future may bring about and it is a source of wonder that our economists and financial men have been and are today so indifferent to the fate of the gold mining industry in the United States. Productive gold mines can not be developed over night. They are made by determined exploration. Once shut down or abandoned because of mounting costs they can not be reopened except by the same expensive processes. It is therefore an entirely mistaken policy to ignore or belittle the position of the gold mining industry among our natural resources and as part of our financial and industrial machinery and particularly in its bearing upon our international trade relations.

As I represent one of the greatest gold mining districts in the explored world, rich with the annuals of that industry, let me tell something of the story of one branch of gold mining in California—that of hydraulic mining.

The golden era of this age dates from the discovery of gold in California by James W. Marshall, on January 19, 1848. The announcement of this discovery electrified the country from the Pacific to the Atlantic, and a sturdy stock of Americans at once started for the new El Dorado. The news of the gold discoveries brought a rush of gold seekers from the eastern states. Enough prospecting had been done in the summer and fall of 1849, to prove the surface diggings to be incredibly rich; individuals, in some cases, having taken out thousands of dollars in gold in a few days.

The rocker was the first machine used for washing the auriferous gravels and was brought into use in the summer of 1848. The rocker was soon superseded by the long-tom. The long-tom in turn gave place to the sluice. Ditches were constructed to bring water to the diggings, and as the miners were compelled to take to the deeper gravel channels, the practice of ground-sluicing came into use. Ground-sluicing was carried on extensively in 1851 and 1852.

HYDRAULIC MINING

About April, 1852, A. Chabot, mining near Nevada City, used a hose of some 35 ft. in length, through which water was conducted from the top of the gravel bank to the bottom of the diggings. There was no pipe or nozzle at the end, but still it was found to be a great saving in sluicing off earth and gravel that had been picked down, and also a convenience in cleaning up the bedrock. So far as known the hose was not used that season

* Member of Congress, 2nd California District.

in any other claims, and it does not appear that Chabot discovered the great advantage that would result by directing the water against the bank.

In April, 1853, E. E. Matterson, who was working a claim on American Hill, near Nevada City, Calif., rigged up a hose, attached a nozzle at the end, and directing it against the gravel bank, as water is thrown upon a building by a fire engine, found that a small stream of water under pressure would do the work of a hundred men in excavating earth and gravel, and moving it into the sluice box. From this discovery of Matterson, of the use and principal of water under pressure in working a gravel bank, the hydraulic mining industry of the world had its birth. Very soon hydraulicing was adopted by the miners throughout the country wherever water and a sufficient fall could be procured.

Later, iron pipe was used in the place of hose, and the nozzle was increased in the size and changed in form, until the hydraulic giant was evolved. From this point on, the development of hydraulic mining was rapid, and by 1876 there was over $100,000,000 invested in plants, equipment and property. This system of mining led to the construction of the majority of the present great lake and canal systems of California.

As the early history of the American occupation of California is associated with the gold miners of "Forty-nine," so the economic development of the state is bound up in the history of hydraulic mining.

Gold Production From Placer Mines

The principal gold placer area of California lies in the Sierra Nevada Mountains between Susanville on the north, to Mariposa on the south. This area from its placer mines has produced since 1848, over a billion dollars in gold. Of this production from placer mining just exactly how much was produced from hydraulic mining is not definitely known, as the statistics that are available do not segregate the gold production according to method until 1897. Waldemar Lindgrew in Professional Paper No. 73, states that the gold production of California up to 1909 amounted to $1,550,000,000. Of this amount he considers that one-fifth came from quartz veins, and the bulk of the remainder from the river gravels that were easily washed. The gravels that were higher in elevation and required hydraulic methods, he considers conservatively produced up to the end of 1909, $300,000,000.

Prof. J. D. Whitney, in his "Auriferous Gravels," written in 1879, states that the gold from hydraulic mining at that time was from $12,000,000 to $14,000,000 per annum. The Miners Association in 1881 estimated that the annual gold production from hydraulic mining was between $11,000,000 and $13,000,000.

Closing of the Hydraulic Mines

A controversy having arisen between the miners and farmers of the valley region over the discharge of debris from the hydraulic mines, into the tributary streams of the Sacramento and San Joaquin Rivers, many court actions were taken against the hydraulic miners, which culminated in the famous Sawyer decision of January 23, 1884. This decision, in the form of an injunction, handed down by the United States Circuit Court, in the case of Edward Woodruff vs. North Bloomfield Gravel Mining Co. et al., practically depleted at one blow property values exceeding $100,000,000.

Loss to California Enormous

The result of the Sawyer decision was far reaching in its effect. The decree of the court was nominally against dumping debris into the streams and rivers tributary to the Great Valley; but in reality hydraulic mining was enjoined in all its major operations.

Thousands of people were thrown out of employment, the gold production of the state dwindled, and property values in the mountain counties were decreased by millions. In the closing of the hydraulic mines, the loss to the state has been tremendous. It has been computed by competent authorities that the loss in gold production due to the closing of the mines from 1884 to 1893 was at a minimum $50,000,000. From 1893 to the present date, it, of course greatly exceeds that figure. The loss to the farmers and merchants of the state may be fairly well calculated as follows: The cost of supplies and labor for the hydraulic mines was between $3,000,000 and $5,000,000 per year. Fifty percent of this was in the form of supplies directly furnished by the farmers of the valley adjacent to the mining region. In the mountain towns, whole communities of several thousand inhabitants were reduced to villages, and in many cases entire communities were wiped out.

In the Sawyer decision the court reserved the power to modify or suspend the injunction upon the showing that conditions had been so changed that the discharge of debris might be conducted so as not to continue the nuisance complained of. That is to say, hydraulic mining was not declared to be illegal, but the discharge of debris into the streams is not permitted.

State Convention

In the fall of 1891 a number of citizens of Placer County decided to call a county convention to see whether anything could be done to revive the hydraulic mining industry. The convention met at Auburn with the object of formulating a plan for a state convention and to memoralize Congress for needed legislation. This state convention was later called in San Francisco and representatives of both farming and mining interests attended. A common plan was agreed upon, both interests realizing that they were dependent, one upon the other. The basis of this agreement was the report of a Government commission of engineers. This commission was appointed by special act of Congress upon the suggestion of the California legislature. It was shown by this report that dams and other restraining works could be erected, in the streams and canyons for the restraining of debris from hydraulic operations.

The state convention requested Congress to accept and adopt the report of the commission and to take steps so that hydraulic mining might be again carried on, and the debris restrained from the rivers. The result of this action was the Caminetti Act, passed by Congress in 1893, and is entitled: "An act to create the California Debris Commission and regulate Hydraulic Mining in the State of California, approved March 1, 1893."

Caminetti Act

The provisions of the act are essentially, as follows: A commission is created, known as the California Debris Commission, consisting of three officers of the Engineer Corps of the United States Army, appointed by the President of the United States, with the advice and consent of the Senate. The jurisdiction of this commission, in so far as hydraulic mining is concerned, extends over the territory drained by the Sacramento and San Joaquin River systems. It is the duty of this commission to make examinations and surveys, which will improve the rivers and insure them against damage due to mining debris, natural erosion, or other causes, with a view of restoring the navigability of these rivers to the conditions existing in 1860, and permitting hydraulic mining to be carried on, providing the same can be accomplished without injury to the navigability of said rivers or injury to the lands adjacent thereto.

The commission is charged with making a study of the hydraulic mining industry, and such research as science and engineering skill may suggest as practicable in devising a method whereby such mining may be carried on.

The commission is empowered, "To erect dams for the retention of mining debris out of a fund provided for this purpose by a tax of 3 percent on the gross proceeds of hydraulic mining operations."

The owners and operators of hydraulic mines are required by law to comply strictly with the regulations of this commission under an extreme penalty of a

$5,000 fine, and one years imprisonment. License of written permissions from the commission must be obtained before hydraulic mining can be carried on. Plans and specifications for the building of all restraining works are submitted for the approval of the commission, and hydraulic mining must be carried on under its supervision. The amount of debris which can be washed is not permitted to exceed the amount which can be impounded within the restraining works erected. In work done by the United States, and the State of California jointly, the commission is empowered to consult with the state engineer, and the result of their findings, if approved by the chief of engineers of the United States Army, is followed by the commission. The power of the commission is arbitrary.

Dams for Hydraulic Mining Authorized

The California Debris Commission act was passed not only to protect farming lands and navigable rivers but was also intended to accomplish the resumption of hydraulic mining. It provides a non-political body of Army engineers, whose duties are to administer the act, survey the rivers for dam sites, erect dams when money is appropriated for the same, and study and research, "in devising a method whereby such mining may be carried on as aforesaid." To quote section 25 of this act in part: Sec. 25. "That said commission is hereby directed and empowered, when appropriations are made therefore by law to build at such points above the head of navigation such restraining or impounding dams and settling reservoirs * * *."

The act further provides the rate of payment that shall be made for mining behind such restraining dams. To quote section 23 in part: Sec. 23. "The individual, company or corporation operating thereunder working any mine or mines by hydraulic process, the debris from which flows into or is in the whole or in part restrained by such dams or other works erected by said commission, shall pay a tax of 3 percent on the gross proceeds of his, their or its mine so worked."

The passage of the Caminetti act aroused great expectations in the mountain counties, but up to the present time no appropriations either by state or Federal government have ever been made for the construction of restraining dams. Other portions of the act have been put into effect.

The condemnatory sections were utilized on the passage of the act.

The permissive sections were also put into action. These permit miners to build a dam on its approval by the Debris Commission, to mine up to the limit of the capacity. Miners or others may combine to erect a dam to serve more than one mine. This provision has been used and is in action.

The protective section has been used. This provision was utilized between 1900 and 1910 by the erection of barriers on the Yuba and a cut at Daguerre Point about 9 miles above Marysville. This was done to protect the adjacent farm lands. This work cost $661,824.14; one-half was paid by the Federal Government and one-half by the State of California.

The vitalizing sections of the act, however, have laid dormant and unused. These provide that dams shall be built by the commission "when appropriations are made therefore by law." Nothing has been done under this section to provide dams for the resumption of hydraulic mining.

$600,000,000 Gold Available

Investigations and examinations made by the California Mining Bureau and the United States Geological Survey prove that there are over 7,000,000,000 cubic yards of gravel distributed among the different drainage areas as follows, approximately: Feather River, 500,000,000 yds.; Bear and American Rivers, 2,500,000,000 yds.; Mokelumne, Consumnes, Calaveras, Tuolumne, and Stanislaus Rivers, 500,000,000 yds.; and Yuba River, 3,500,000,000 yds.

The above total of 7,000,000,000 yds. is not all available for working from an economic standpoint. Forty percent, due to location and available water, is not feasible to be worked. This leaves about 4,000,000,000 cu. yds. of gravel, which, judging from past values per cubic yard, if hydraulic mining is restored under proper restrictions, will yield about $600,000,000 in gold from these drainage systems alone. These deposits are the largest auriferious gravel deposits known to the mining world, and the only process by which they can be worked at a profit is by hydraulic mining. Can California, can the United States, suffer this great treasure to be forever locked up in our mountains?

The erection of substantial concrete dams at controlling points on the Feather, Yuba, Bear, American, Cousumnes, Mokelumne, and Calaveras Rivers, under the Caminetti Act, will make possible the mining of these deposits.

These dams will take care, not only of the hydraulic mining débris but also the natural erosion which is now being carried into the Sacramento and San Joaquin Rivers. It has been estimated that the amount of natural erosion is from 100 to 200 percent greater than the amount caused by the mining operations.

Advantage of Dams to State

The advantage that the State of California will receive from the construction of these dams under the Caminetti Act is enormous.

By retarding natural erosion, the Sacramento and San Joaquin Rivers, notably the former, would begin cutting its bed down to the original old grades, with the result of the restoration of navigation in these rivers up to Marysville, as in former days. The advantage to the farmers of convenient water transportation on the Sacramento River would be of great value. The expense of dredging and keeping the channel clear on both the Sacramento and San Joaquin would be eliminated. The expense and necessity of building levees would be gone in a few years. The advantages to the Sacramento and San Joaquin Valleys from the flood protection offered by these dams is incalculable. A large amount of electric power at low cost would be available.

Provisions would be made for the storing of only a certain amount of hydraulic mining débris behind the dams, thus leaving available a large quantity of stored water for agricultural purposes, which would be supplied to the farmers at an extremely low cost. This water could be supplied to the farmers at a nominal cost, due to the expense of building the dams being repaid to the Government out of hydraulic mining operations.

Thousands of men would be employed in the mines and millions of dollars of new gold produced annually.

Project Approved by Engineers

Many of the dams and reservoir sites have already been surveyed and examined by the state and débris commission engineers, and reports rendered on different portions of the project. These investigations and reports show conclusively that the plan is sound and feasible in every respect, there being more than sufficient dam and reservoir sites than is necessary for every phase of the project, and that hydraulic mining can be resumed without possible injury to anyone or any community.

Under the provisions of the Caminetti Act, these dams are provided to be constructed, when appropriations for the same are made available. The original cost to be borne by the Government, State or Federal, to be repaid by a 3 percent income tax from the operation of the hydraulic mines. The construction of the dams will also inure greatly to the advantage of the farmers of the state by virtue of the reclamation of several hundred thousand acres of waste land, by storage of water during the wet months and delivering it in the dry season when needed, by permitting the rivers to cut down to their old grades and give transportation and navigation to Marysville and Colusa, as in former days. It will also give the farmers a greater home market for their products, due to the increased prosperity of the mining counties. (*Continued on page* 766)

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Photo by Carlock

And the woods against a stormy sky
Their leafy branches tossed.

REPORTS ON THE MECHANIZATION SURVEY

Entry Driving By Mechanical Loaders — Developing Main Entries For New Mines—Driving Narrow Work For Retreating Mining Systems—Entry Driving Shown As Part Of A Completely Mechanized Mining System

By G. B. SOUTHWARD

Entry driving in bituminous coal mines is being done successfully with various types of mechanical loading equipment. Machines designed as entry drivers and confined strictly to this class of service have been in use for several years while mechanical loaders, scrapers and conveyors—in addition to working rooms, pillars and long faces—are also being used in narrow work.

Quite a number of these operations are making remarkable records in their rate of entry advancement. The reports shown here however are not taken from those showing the best records, but are being submitted as examples of how this rapid entry advancement by mechanical loading is leading to the adoption of retreating mining systems.

THE four reports which are here submitted are illustrating the adaption of mechanical loaders to entry driving applied in the development for retreating mining systems. Numbers 1 and 15 illustrate how this development is being coordinated with other mechanical loading so as to form an integral part of a completely mechanized mining system; numbers 37 and 118 show the entry driving applied to the development of new mines, which will be worked by strictly retreating system. Both of these types of operations are of particular interest to the bituminous coal industry, as the advantages of retreating mining have long been recognized and the importance of shortening the development period of a new operation can hardly be under-estimated.

In these four examples there are no particularly severe mining difficulties encountered. Number 118 has a draw slate 12 in. thick, which comes down or has to be taken down immediately after the seam is mined, but this is an added expense which occurs after the loading has been done and does not interfere to any serious degree with the loading operation itself. In Number 15 the top is a slate which will not stand without timber, even in headings, and temporary posts are usually required to be set during the loading operation. These are later removed and replaced by permanent roof supports, and this work is considered as part of the general mine maintenance and not as a part of the entry driving. In Numbers 1 and 37 about 12 in. of top coal is left up to support the roof, and little, if any, timbering is required or used in the entries.

All the seams shown in these reports have some impurities, but, with the exception of Number 15, these are small and no attempt is made to remove the slate inside the mine. In Number 15 there is a 12-in. parting in the coal which is separated and loaded out as refuse by the machine operation as described in the report. This, of course, adds to the expense of the loading, but this extra expense would also occur in hand mining. In the other three mines the impurities which occur in the seams are removed on picking tables at the tipple. This in each case has necessitated some increase in the labor required for picking as compared to the amount required when the mining is done by hand loading.

Since all these operations are in narrow work the percentage of lump coal produced by the mechanical loaders is not expected to be as high as that obtained from the room and face work. At Number 15 there is no desire or attempt to make lump coal. At Numbers 37 and 118 the managements report that the mechanically loaded coal has a higher percentage of small sizes than from hand loading, but at 118 the inside preparation is now being given more attention and better results are being attained. In operation No. 1, shearing machines or hand snubbing is used in the entry work, and the management reports that the sizes from mechanical loading compare favorably with the sizes obtained from hand loading.

Report No. 118 describes the main entry development of a new mine starting from the slope bottom. Two mechanical loaders are used in the four main entries, one loader being used for each pair of headings. The mechanical mining in the main entries is being supplemented in this operation by hand loading in the panel headings, while the main entry advancement is proceeding to the property barrier. Since the mechanical loaders were installed about nine months ago, the main entries have driven a distance of 3,500 ft.

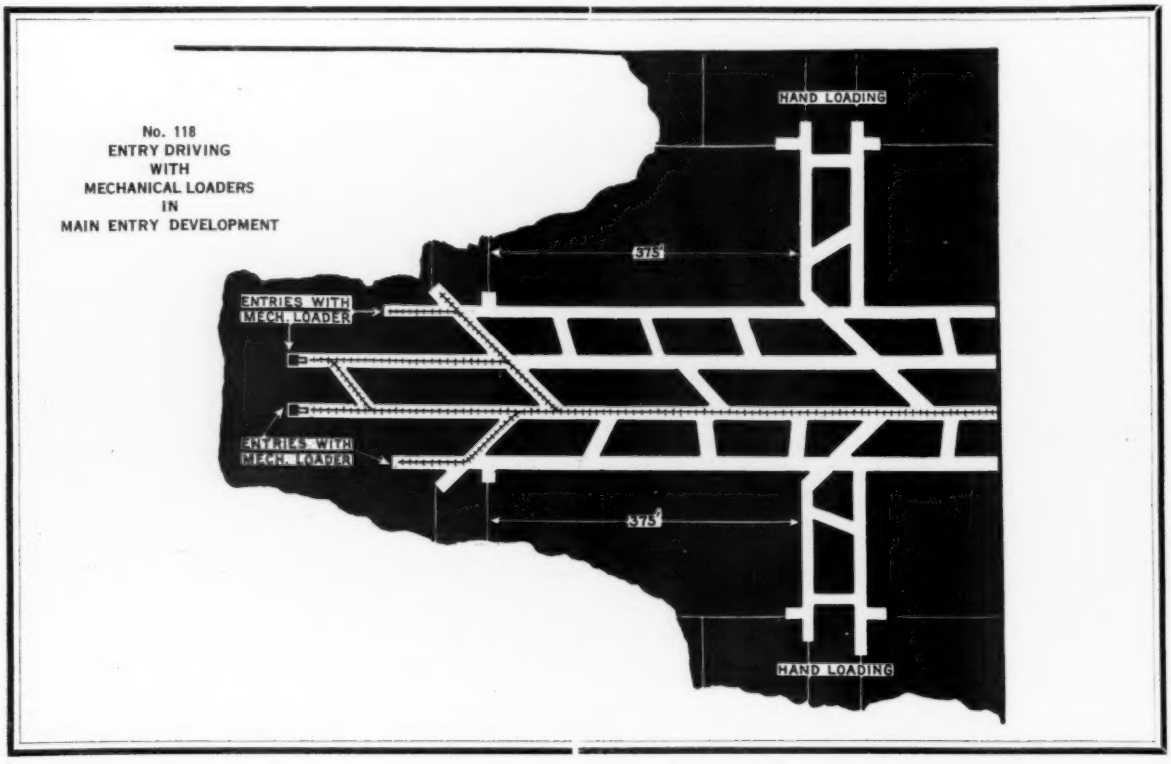
The operation in Report No. 37 is developing the main entries, the panel entries, and the line rooms by mechanical loaders, and no hand mining is supplementing this mechanical operation. One machine is confined to a panel entry and loads out two cuts from each heading during the shift. The line rooms are also driven with the development in order to provide additional working places for the machines, while the cutting and other preparatory work is being done for the second cut in the entries. Three main entries are worked with one mechanical loader and are advanced at the rate of two cuts during each working shift. This operation is being developed for retreating room and pillar mining and it is the intention to use mechanical loaders for this retreating work.

Report No. 1 shows mechanical loaders developing room and pillar panels and the entry development is followed by other loading machines in the room work. The rooms are mined semi-retreating; that is, after the panel has been developed all the rooms are advanced abreast. In this operation speed of development is not the primary object, and the entries are advanced at a sufficient rate so as to keep just ahead of the room work. This is an example of a completely mechanized mining operation. One mechanical loader develops two panel entries, and, as two mechanical loaders are used for the room work in each panel, this means that one mechanical loader in the entries is doing the development work for four mechanical loaders in the room advancement.

In Report No. 15 mechanical loaders are developing panels which are mined retreating by long face conveyors. This is also an example of complete mechanized mining. The entry driving in this operation is working double shift, averaging more than two cuts a shift, while the faces are retreating at the rate of one cut per day. The heading advancement is therefore going at twice the rate of the face retreat and apparently the operation is unbalanced. However, as the sketch shows, there are at present two faces in operation, and the speed of development is being hastened so that additional faces may be started.

In all these operations, with the exception of Number 15, each machine loads directly into mine cars, and is served by a gathering locomotive. In Number 15, by having one loader discharge onto a conveyor which loads into a trip of mine cars, one gathering locomotive serves two machine operations. In No. 1 a new type mine car of 4½-ton capacity has recently been installed. The other operations use cars of slightly over 2-ton capacity.

Report No. 118



PHYSICAL CONDITIONS: The seam is 7½ ft. high of hard structure coal with several small partings. The top immediately over the coal is a draw slate 12 in. in thickness; this is taken down in the haulways and loaded out by hand. In the air courses about 6 in. of head coal is left unmined. Medium hard fire clay bottom. Seam is nearly level. Cover 100 ft. Closed lights.

MINING SYSTEM: The mine is in the development stage and the mechanical loading so far has consisted of driving entries and developing panels for mining retreating by a modified room and pillar method known as the "block system." The present plan has four main entries with panel entries turned off both right and left at 375 ft. intervals. All headings are 11 ft. wide on 60-ft. centers.

MECHANICAL OPERATION — ENTRIES: The four main entries and the panel entries as far as the first line room are being driven with two mechanical loaders; each machine has two entries with the cross cuts and the slant haulways for the panel entries as its working territory. Each loader is equipped with a 6-ft. cutting bar and operates continuously cutting and loading, completing as many cuts as possible during the shift, and remains in one entry until it has advanced 200 or 300 ft. The adjacent air course in the meantime has been advancing by hand loading but as the rate of driving is considerably less by hand than by machine it is necessary for the mechanical loader from time to time to drop back into the aircourse and advance it also. The loading machine is transported on a truck, but at the working face is moved by ropes and jacks similar to a short wall coal cutter. A small electric blower with flexible tubing is used to ventilate the advancing headings.

The loading machine discharges directly into mine cars of 2-ton capacity which are placed by a gathering locomotive; one locomotive serves both machines and while one machine is loading the other operation is cutting, drilling and shooting. The gathering locomotive brings 5 cars at a time from the main line side track which is generally within 200 ft. of the working face and shifts out single loads onto a switch in a nearby breakthrough. A single track with 25-lb. steel on 42-in. gauge is used at the working faces.

The faces are drilled with an electric hand drill, shot with permissible explosives and electric firing. The loading machine will dig out a face which has been shattered by the explosive but not brought down as loose coal.

TIMBERING: The top above the draw slate stands well in entries and practically no permanent timbers are required. Occasional temporary posts are set to hold up the draw slate until the coal has been loaded out.

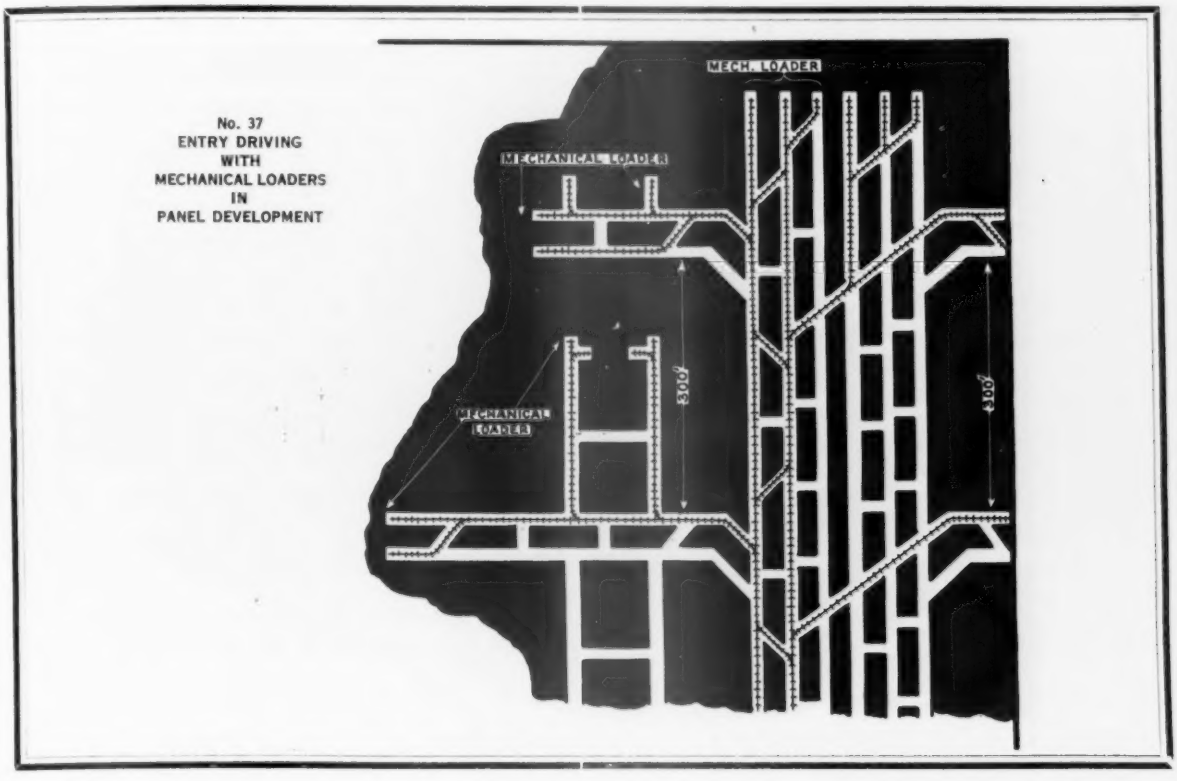
OPERATING CREW—ENTRY DRIVING: A regular crew of 3 men is employed for each machine, consisting of 1 operator and 2 helpers. These men do all the work required at the face, such as cutting, loading, drilling and shooting. A gathering locomotive crew of 2 men serves two loading machine operations. This makes an average of 4 men for each machine and from 2½ to 3 cuts are loaded out from an entry during each 8-hour shift. Some additional labor is required along the haulway to take down and load out the draw slate. Each face cut usually produces 20 tons of coal, making an average production of 50 tons during each shift, and, as both machines work double shift, the average daily production for each machine is about 100 tons.

PREPARATION: Very little slate picking is done at the face and impurities in the coal are removed at the tipple on picking tables. As the loading machines are used in narrow work, a high percentage of lump coal can not be expected and the management reports that the sizes as compared with hand mining show a marked decrease in the large lumps, a 10 percent increase in the slack produced and a larger proportion of egg and nut sizes. Recently however more care has been given to preparation and an improvement in the sizing is resulting.

EQUIPMENT: Each machine operation uses 1 loading machine, 1 electric hand drill and 1 blower fan with tubing for ventilation. One gathering locomotive serves 2 operations.

CONCLUSION: Loading machines were installed for entry driving at this mine about 9 months ago and the two machines have now advanced the four main entries a total distance of 3,500 ft. This shows an apparent average of 200 ft. per month for each machine working double shift. This average, however, includes the time spent in experimental work and in perfecting the working organization for the machine operation, and does not represent the present performance. The management reports that they are now averaging a 15-ft. advance for each machine working shift. This rapid rate of development materially decreases the development cost of a new mine, and the management at this operation considers that their mechanical entry driving is highly satisfactory.

Report No. 37



PHYSICAL CONDITIONS: The seam is 8½ ft. in thickness of hard structure coal with two small partings and a seam of slate averaging about 1 in. in thickness. About 7 ft. of coal is mined leaving from 12 to 18 in. of top coal up for roof. Hard fire-clay bottom. Seam nearly level. Cover varies from outcrop to 300 ft. Open lights.

MINING SYSTEM: This mine is being developed for a retreating room and pillar system and the headings and line rooms are now being driven with mechanical loading. Panels 300 ft. wide and about 2,000 ft. long are developed by six main entries with double butt entries at 300-ft. intervals, which will be driven to the barrier limit before room and pillar work is started. The haulways are 10½ ft. wide, the air courses 14 ft. wide, and the rooms are 12 ft. wide on 100-ft. centers with breakthroughs every 100 ft.

Under the present development plan one loading machine is used in each pair of butt entries, with line rooms driven at such intervals as to provide at least two additional working places. Usually two entries with two line rooms is taken as the regular territory for each loading machine, and the entries are cut and loaded twice during a working shift, and the line rooms once. This makes an average of six clean-ups each shift for the loading machine. In the main heading development, one loading machine drives three entries with two cuts loaded each day from each entry.

MECHANICAL OPERATION: The loading machine works on caterpillars and loads directly into mine cars of 2-ton capacity which are placed one at a time by a gathering locomotive, one gathering locomotive serving each machine. Track is laid with 20-lb. steel rail on 42-in. gauge in each working place and a sidetrack with a 15-car capacity is maintained in either a room or heading breakthrough within 250 ft. of a working face.

All coal is machine undercut 7 ft. and drilled by an electric drill mounted on the cutting machine. Permissible explosive is used with electric firing with five shots for each place. The two bottom shots are fired first, placed about 3 ft. above the bottom, and this coal is loaded out before the top coal is shot down. Three top shots are used. An average of about 14 sticks is used in each place which produces approximately 6 tons of coal per pound of explosive. The coal is well broken so as to eliminate much digging by the loading machine, and the management reports that about 15 percent more powder is used than in hand loading.

TIMBERING AND ROOF ACTION: The top coal makes a very good roof and no timbering is required in the development work except occasionally when bad top is encountered.

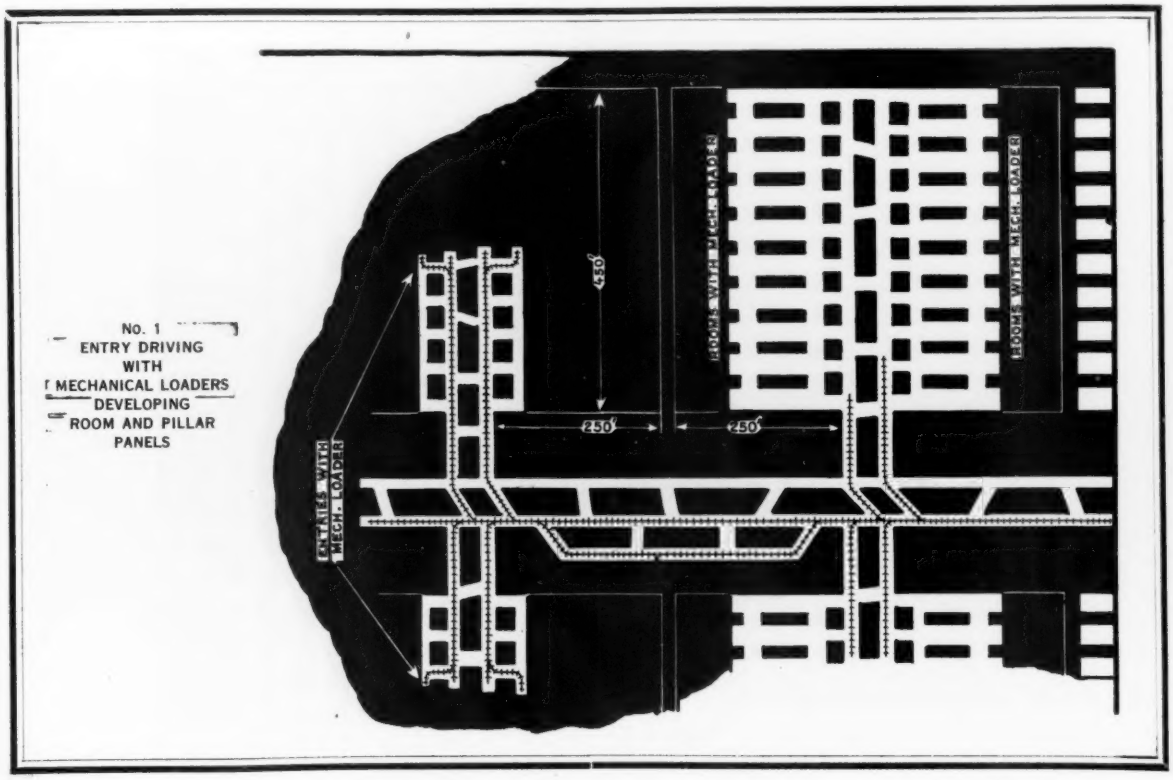
OPERATING CREW: All work is done during the day shift of 8 hours with the cutting, drilling, shooting and trackwork following immediately behind the loading machine in a continuous operation so that one place may be cut and loaded twice during a single shift. Each operating unit has a total of 8 men—1 machine operator, 1 helper, 1 bottom scraper, 1 trackman who also acts as shotfirer, 1 motorman, 1 brakeman, and 2 cutting machine men who also do the drilling. Each machine crew will ordinarily load six places in an 8-hour shift, producing from 20 to 25 tons per place. A record at this mine for several machines over a year's period gave an average tonnage of 110 tons loaded per machine shift including all machines and not excluding time lost from various causes. This record is all in narrow places which will average less than 13 ft. wide.

EQUIPMENT: Each operating unit uses 1 loading machine, 1 cutting machine with a mounted electric drill and 1 gathering locomotive.

PREPARATION: Some slate is picked inside, but the management depends on picking tables at the tipple to insure a clean product and mechanical loading has necessitated some increase in the number of handpickers used. The mechanical operation produces about 10 percent more coal under 3 in. than hand loading at this same mine.

CONCLUSION: Loading machines have been used at this mine for about two and a half years, the first use being experimental in driving entries and rooms and also in pillar recovery. The management reports that their observations during this period convinced them that entries and rooms could be driven at twice the rate of hand loading and that pillar recovery by crosscuts and pockets was practicable with machine loading. In their opinion the pillar work was not as safe with machine as with hand mining and the machine operation was less efficient in pillar recovery than in entry and room work. They also report, however, that their mechanical loading operation is effecting some economies over hand mining, but that very careful supervision is necessary to achieve this result and constant inspection is advisable to insure against mechanical breakdowns. The rapid rate of advancement, however, is a distinct advantage which is had over and above the direct saving effected in the operating cost.

Report No. 1



PHYSICAL CONDITIONS: The seam as mined is 7 ft. high, hard coal with 4½ in. of partings in several small bands of 1 to 2 in. in thickness. Some top coal is left for roof and stays up well in rooms without much timbering. Soft fire-clay bottom. Seam nearly flat. Cover 250 ft. Closed lights, entries rock dusted.

MINING SYSTEM: The mine is worked by the room and pillar system with mechanical loading in the rooms and the entry development. Panels 610 ft. wide are developed by a pair of headings in the center which are driven 530 ft. to the panel barrier before any rooms are started and the development operation also includes driving the room necks as far as the first cross cut. The entries are 12 ft. wide on 30-ft. centers and the room necks are 18 ft. wide turned on 45-ft. centers. After the narrow work has reached the panel limit the rooms are then mined with mechanical loaders and this operation will be covered by a later report.

MECHANICAL OPERATION: Two room entries with the room necks and the two main haulage entries constitute the territory for one loading machine and provide 10 working places for one operating unit. The loading machine travels from place to place on trucks which are removed when at the working face and the machine loads from caterpillars. The loader discharges directly into mine cars which are placed one at a time by a gathering locomotive. Two types of cars are used, one having a capacity of 3½ tons and a newer type recently installed which has a capacity of 4½ tons. The gathering locomotive brings from three to five cars from the main line side track to the loading machine and shifts single loads into an adjoining working place. Single track of 25-lb. steel on 42-in. gauge is used along the haulways and in the rooms.

All work is carried on continuously during the day shift with the cutting, drilling and other operations following directly behind the loader. Each mechanical operation through its foremen reports by telephone to the office on the surface every two hours during the day shift reporting the tonnage loaded and any delays which have caused or may cause any interruption to the work.

All entries are undercut by machine with a 7-ft. bar and in most cases are sheared with one shear cut. The coal is drilled by an electric hand drill and fired by permissible explosive with electric caps. Where shearing cuts are not made, snubbing shots are placed about 18 in. above the bottom of the seam and this coal is pulled out by hand snubbers before the top coal is shot down. Generally two bottom shots and two top shots are used in each heading and the coal is fairly well broken so that not much digging is required by the loading machine.

TIMBERING: The roof generally stands well and only occasional timbering is required in the entries and room necks.

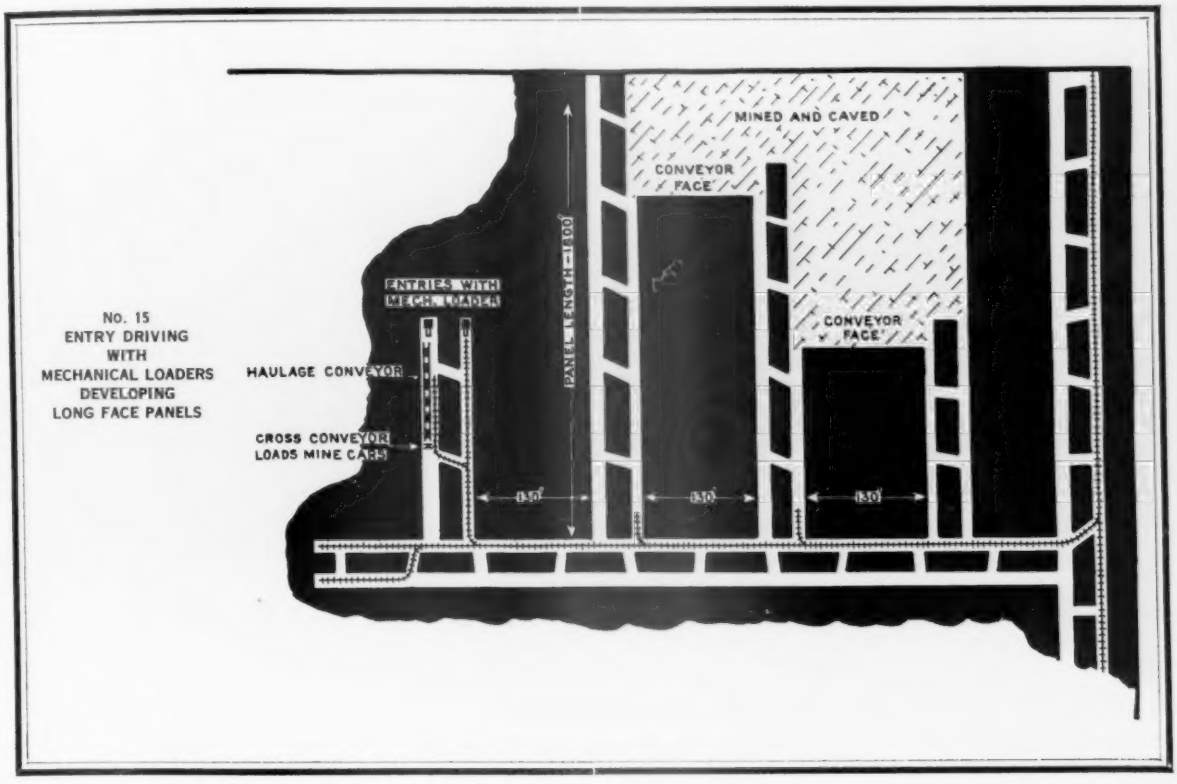
OPERATING CREW: All work except the shooting is done on the day shift of 8 hours with the cutting, snubbing and shearing following behind the loading machine. In the entry development one loading machine operation uses a regular crew of 13 men—1 machine operator, 1 helper, 2 men for the gathering locomotive, 2 cutting machine runners, 1 shearing machine runner, 1 hand-loader, 2 drillers who shovel the bug dust and load the shots, 2 trackmen and 1 foreman. Where the shearing machines are not used 2 hand snubbers replace the shearing machine operator. Each machine will load from 4 to 5 places during the shift, each place producing from 25 to 30 tons, making an average daily production from the machine in entry work of 125 to 150 tons.

EQUIPMENT: Each loading machine operation has 1 mechanical loader, 1 cutting machine, 1 shearing machine, 1 gathering locomotive and 1 electric hand drill.

PREPARATION: Considerable study and experiment has been made in this operation to produce as high a percentage of lump coal as was formerly produced by hand mining and the snubbing and shearing methods now in use have resulted in a proportion of screen sizes nearly approximating that of hand mining. Little attempt is made to remove slate in the mine and the force of slate pickers now employed on the tipple will nearly equal one picker per 100 tons of coal mined. This is quite an increase over that required for hand mining and it has also been necessary to increase the size of the picking tables and to increase the slate refuse handling facilities.

CONCLUSION: Mechanical loaders have been used at this mine nearly three years and about 96 percent of the output is now being loaded mechanically. In this operation the entry driving is not planned to advance faster than is required to keep ahead of the room work and economy of mining has been the aim rather than a high development speed. Constant supervision has resulted in a very satisfactory and efficient operation and the management considers their mechanical loading as successfully competing with hand mining under similar conditions.

Report No. 15



PHYSICAL CONDITIONS: The seam is 8 ft. high, of fairly hard coal with 12-in. bone parting near center. Slate top which usually requires timbering in the entries varying from posts to steel crossbeams. Hard clay bottom. Seam generally flat. Cover 350 ft. Closed lights. Entries rock dusted.

MINING SYSTEM: The mine is being worked by long faces retreating using conveyors on the faces and mechanical loaders for driving the entries. The panels are developed by a pair of main haulage entries with double entries turned off at right angles at 130-ft. intervals and driven 1,800 ft. to the barrier limit. The entries are about 12 ft. wide on 40-ft. centers and develop the panels ahead of the face mining so that a strictly retreating system can be used. The 130-ft. blocks between these entries are recovered by conveyor faces which will be described in a later report.

MECHANICAL OPERATION: The entries are driven in pairs with one loading machine staying in each heading and advancing it from the haulage entry to the panel limit—a distance of 1,800 ft.—and also driving the crosscuts through the chain pillar. When at the working face the machine sets on the pavement and is moved by ropes and jacks similar to a coal cutting machine, but when it is required to transport it to a new panel it travels on a truck. Each mechanical loader is equipped with a 6-ft. cutting bar and operates continuously, cutting and loading, completing as many cuts as possible during the shift.

One loader discharges directly into mine cars. The other loader discharges onto a haulage conveyor which is laid on the pavement along one rib of the entry and conveys back to a track where mine cars are placed. At this point it is elevated and discharges onto a short conveyor set at right angles to the track which loads into the center of the mine cars, which are moved in solid trip by a rope hoist. The haulage conveyor is sectional and is lengthened each day as the entry advances, the loading point remaining stationary until the conveyor has been extended to its maximum length of 250 ft. The gathering locomotive places a trip of 15 mine cars at the conveyor discharge point and while this trip is being loaded the locomotive serves the other machine by placing cars one at a time and shifting them onto a sidetrack laid through a breakthrough to the adjoining entry. The tracks are laid with 40-lb. rail on 42-in. gauge and the mine cars have a capacity of 2¾ tons.

The entries are shot with permissible explosive and electric firing, using nine shots to each cut. Three shots are made in the bottom coal under the parting and this coal is loaded before the next three shots placed immediately above the parting are fired. The parting is shot down and loaded out as refuse coal into mine cars by the machine and three top shots are then used to bring down the top coal.

TIMBERING: The roof requires timbering which varies from posts to steel crossbars. Usually temporary posts are set and maintained close to the machine operation and the permanent timbering is set later.

OPERATING CREW—ENTRY DRIVING: The mechanical loaders work on double shift, each shift being 8 hours long. No regular task is to be performed during the shift, but the crew works continuously cutting and loading, completing as many cuts as possible during the shift. Each machine has a regular crew of 4 men who do the cutting, drilling, shooting and loading. Where the haulage conveyor is used, this crew consists of 1 machine operator, 1 helper, 1 car trimmer and 1 man who operates the rope hoist. Where the machine loads directly into mine cars the crew consists of 1 operator, 1 helper, 1 car trimmer and 1 motorman for the gathering locomotive. An average of from 2½ to 3 cuts is usually loaded out during each shift—1 cut advancing the heading about 6 ft. and producing approximately 20 tons of coal.

PREPARATION: The coal is not screened at this operation, consequently no great effort is made to produce lump coal and no figures are available to show the comparison of the sizes produced by hand loading and machine mining. In the entry driving the slate parting is shot down and loaded out separately by the machine and the management reports that the quality of the coal from the mechanical mining compares favorably with that obtained by hand loading.

EQUIPMENT: Each entry uses 1 mechanical loader and 1 electric hand drill. In addition to this, one operation uses a sectional chain conveyor 250 ft. long, a short cross conveyor 8 ft. long and a rope hoist; the other operation uses one gathering locomotive.

CONCLUSION: Mechanical loaders have been used for entry driving at this mine for about nine months and are considered successful by the management in driving entries at a rate much greater than would be possible by hand mining. This permits a retreating long-face method and a corresponding reduction in the number of working places required to produce a given output.

COAL

PRACTICAL OPERATING MEN'S DEPARTMENT

NEWELL G. ALFORD, Editor

Practical Operating Problems of the Coal Mining Industry

ROCK DUSTING AS PRACTICED BY GALLUP AMERICAN CO.*

Hazards Of Coal Mining—Accident Causes Discussed—Explosions In Non-Gaseous Mines—Rock Dusting By Machine—Rock Dust Barriers—Gas Explosions Extinguished—Proper Methods And Rigid Inspection Necessary To Insure Safety

By HORACE MOSES† and L. M. KUHNS‡

THIS year, 1927, is the 120th in the history of the United States during which statistics have been kept on the production of coal. Some coal was mined prior to 1807 but no records of production were made. In 1821 the total production was about 1,300 tons; the following year this was increased to 54,000 tons and at the time of the Civil War had increased to 16,000,000 tons. In the year 1882 production passed the 100,000,000-mark and in 1926 over 650,000,000 tons were produced in the United States.

It is difficult to realize the vastness of the mining industry in this country, but an impression may be gained when one realizes that 60 percent of the total amount of freight hauled by the railroads during the year 1926 was freight produced by the metal and coal mines, and of this 70 percent was from the coal mines alone.

The mining of coal being inherently a hazardous occupation, the industry has not been developed and built up without many accidents and much loss of life, although, by using modern methods and many safety devices the accidents are being lessened from year to year. Statistics show that from 1906 to 1925, inclusive, there was one fatality for each 253,093 tons of coal produced in the United States. About 50 percent of all accidents at coal mines are caused by falls of rock, coal, timbers, etc., another 35 percent by haulage, explosives, electricity, machinery, etc. The remaining 15 percent are caused by explosions of gas and coal dust and make up that part of coal mine accidents most readily preventable.

Different mining organizations have endeavored to formulate safety codes and have tried to adopt a definition of what constitutes gaseous and non-gaseous mines. After having spent several years on this question, the United States Bureau of Mines had divided all mines into three groups and defined a non-gaseous mine as one in which inflammable gas in excess of one-half of one percent can not be found by systematic search. The mines of the Gallup American Coal Co. come under this classification, as methane has never been found in the Gallup district. However, all precautions are taken and the mine is treated

Rock-dust barrier—V type

* Paper presented before meeting of New Mexico Chapter of The American Mining Congress, Santa Rita, N. Mex., July 25 and 26, 1927.

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as though it were gaseous, hoping to forestall any calamity that might occur in the way of an explosion. It has been demonstrated in the past few years that explosions can occur in non-gaseous mines, as fine coal dust is inflammable and, once an explosion is started by the ignition of coal dust, it can be carried on to such an extent that the entire mine can be completely wrecked. The principal safety methods used at No. 5 mine to reduce the explosion hazard to a minimum are the use of rock dust throughout the entire mine to dilute and render the coal dust harmless, the use of permissible explosives only, the use of closed lights, permitting of no matches or smoking in the mine and particular attention given to ventilation so that any gas which might be found would not be allowed to accumulate. All blasting is done by electricity by shot firers when no other persons are in the mine.

Parting after one application of rock dust with machine

Gypsum is used for rock dusting purposes and is applied, where tracks are available, with a machine especially constructed for that purpose. The rock is shipped in just as it is blasted from the quarry and is first put through a jaw crusher and then through a KB hammer pulverizer where it is reduced to a point where 80 percent will pass through a 200-mesh screen. The dusting machine is pulled by a mine locomotive against the air current and is run from either the trolley wire or the battery of a combination locomotive. No specific amount is applied per foot of entry but a good heavy coating is given and samples are taken soon after and analyzed. Sampling is done by the vacuum method where electricity is available and by brushing where there is no electricity. It has been found that a good coating of the haulage roads once a year is sufficient and the air courses need treatment only about once in three years. Volumetric tests made on the main north entry show that before the entry was first rock dusted, the roof and rib samples contained only 7 percent of incombustible matter; immediately after having been rock dusted the roof and rib samples contained 99 percent incombustible, and one year after rock dust was applied the roof and rib samples still contained 83 percent incombustible. However, it was considered advisable to again rock dust this entry, as practically all of the combustible matter was in the form of an outer coating over the gypsum dust. In the air courses, where there is no track, the dust is applied by means of a jet or injector constructed in the shop at the mine. This is attached to a compressed air line and the dust is blown into the air current. This is done every 500 feet along the air courses and the dust makes a very satisfactory coating for that distance.

As a second line of defense against coal dust explosions, rock dust barriers are installed at the mouths of all cross entries and distributed at various places along the haulage roads and air courses. There are several types of barriers, but perhaps the most efficient, least costly and most easily installed and maintained is the V trough type, which is the type in use at the No. 5 mine. This consists of a battery of from 20 to 30 troughs placed at right angles to the entry near the roof and just far enough apart so that each one can be tipped over without touching the next one. Each trough is filled with finely pulverized, incombustible dust and set at each end in a notched holder. The pioneering compression wave traveling ahead of the flame of an explosion will overturn the troughs of the barrier and allow about one-half of the contents to be discharged into the air. The balance of the dust will trickle from the troughs gradually and, when the flame of the explosion reaches that point, it will encounter a dense cloud of incombustible dust and will be extinguished.

The cost of rock dusting a mine has been found to compare very favorably with any other method of rendering coal dust harmless. Two men are required for the operation of the dusting machine and they can give a good coating to about one mile of entry during an eight-hour shift. The cost of the dust itself would, of course, depend upon the location of the mine in regard to a place where the proper kind of rock is available. The gypsum for Gamerco is quarried near Laguna, which is about 100 miles from the mine. The cost of keeping the mine thoroughly dusted and of erecting, moving and maintaining barriers is one and fifteen hundredths cents per ton of coal mined. This includes the cost of the rock, freight, crushing, pulverizing, distribution and materials and labor for building and filling barriers; also repairs and replacements for machinery and equipment.

One of the drawbacks to protection by rock dust is that, in many mines, a nice veneer of white dust is put on those parts of the mine which are most readily accessible and where it will show the most, and the balance of the workings are neglected. For this reason, far reaching explosions can occur in so-called rock dusted mines and discredit the practice of using rock dust. Last year an explosion occurred in the largest mine in the world (the New Orient in Illinois). This mine is thoroughly rock dusted and the explosion was confined to a very small area, causing the death of only five men. Had no such precautions been taken, it is almost certain that a large percentage of the other 1,200 men then at work in the mine would have been killed. Recently an explosion took place in the Delagua mine in Colorado and, out of 161 men in the mine at the time, only 6 were killed. The decision of experts who examined the mine later was that, if it had not been for the very thorough rock dusting, the entire force would have been caught. This same Delagua mine was the first mine in the United States to resort to rock dusting as a means of preventing explosions of

coal dust when, in 1911, sweepings from the surrounding wagon roads and highways were distributed by a machine designed and built at the mine.

Recently, at Everettville, W. Va., a mine explosion occurred which was caused by a small body of gas being ignited by a spark from a mine locomotive. The mine was very wet and was considered by the operating company to be safe from coal dust explosion for that reason. Although some rock dusting had been done in certain sections of the mine about 10 months previous to the explosion, the mine was not thoroughly rock dusted. The pocket of gas which was ignited would probably not have caused more than a flash, with injuries to the two men on the motor, if it had not been for the coal dust present which ignited and caused a violent explosion, carrying to almost all parts of the mine, killing 91 men in the mine and wrecking the tipple and killing six men who were working outside. This company had been warned by the state inspection department that the mine was not in a safe condition and it was recommended that the mine be thoroughly rock dusted.

Next to rendering coal dust inert, we consider efficient ventilation to be the most important factor and extreme care is taken to provide all working places with sufficient air to move any accumulations of gas or smoke. The ventilating fan is now forcing 120,000 cu. ft. of air per minute into the mine, which, if efficiently handled, is ample to properly ventilate the entire mine. The fan intake is equipped with steam radiators capable of increasing the temperature of the intake air 50 degrees F. so that during the winter months ice is not allowed to accumulate in the shaft and air courses and interfere with the ventilation currents. By the use of these radiators, an even temperature is maintained throughout the year which also eliminates the drying out process of mine workings which usually takes place during the cold weather. Falls of rock, coal and timbers being the commonest causes of injuries in all coal mines, especial attention is given to this phase of mining at No. 5. The nature of the roof, which consists of shale, necessitates close and systematic timbering and, even though this feature is given the closest supervision, hardly a working day passes without some miner being injured from this source. While most such accidents are slight, there has been one fatal accident and two men were severely injured since the first of the year. By close supervision, systematic timbering and eternally impressing the miners with the idea that they are responsible for the condition of their working places and that they must assume such responsibility, it is hoped that accidents will be greatly reduced.

THE PUBLIC DOMAIN

(*Continued from page* 755)

cluded within the 200,000,000 acres of unreserved public lands remaining undisposed of there are still opportunities for homes, particularly upon the lands which may be reclaimed under the Federal reclamation act. The projects already constructed have provided for the irrigation of 1,320,300 acres of land which, in 1926, produced crops having a gross value of $62.45 per acre, and furnished an additional supply of water under the Warren Act to more than a million acres of land, which produced crops having a gross value of $56.40 per acre. Several new projects have recently been authorized by Congress and are under construction. The money to build these projects for the development of the West comes from receipts from the public lands and resources. The cash receipts under the general mineral leasing laws for a period of approximately six years, to July 1, 1926, were $56,400,749, of which 52½ percent went into the reclamation fund for the irrigation of arid lands in the western states, and 37½ percent, or $18,181,527, was paid to the states in which the deposits were mined.

Many millions of dollars have been and are being spent for the construction of good roads in and adjacent to the national forests, national parks, and Indian reservations, contributing to local prosperity and subject to local use. The Government's percentage of the cost of these new highways is fixed at a rate averaging 62.9 percent.

The conservation of the natural resources of the public domain, and particularly of such exhaustible resources as timber, oil, gas, coal, shale, potash, phosphate, and sodium, became the subject of widespread interest during the administration of former President Roosevelt, and the adoption of a general policy with respect thereto resulted in the reservation of timbered areas for the preservation and perpetuation of national forests and protection of stream flow. This was followed, as the value and necessity of a sensible and uniform policy as to deposits of oil, gas, shale, coal, potash, phosphate, and sodium became apparent, by the enactment of the so-called general leasing laws, which previously had had eight years of thorough consideration by the Congress. The same year Congress adopted a national policy with respect to water-power development upon public lands, reservations, and navigable streams. These laws permit of a broad and uniform policy for the care, preservation, development, and use of the resources. They are designed to procure the maximum production with the minimum waste. They permit of development under a uniform policy, beneficial alike to the individuals engaged in the development and to the public which uses the products. Such a policy is calculated to prevent monopoly, as well as to prolong the life and use of the exhaustible resources.

With the exhaustion of soils on our farms by continued cultivation, with insufficient fertilization, the necessity for the ultilization of the large deposits of phosphate and potash in the public domain will become increasingly important. The use of the various minerals I have described as fuel and fertilizer minerals is not local, but national, and every citizen has a vital interest in their care and use, to the end that the widest benefit, the least waste, and the greatest common good may be realized therefrom. How better can this be secured than through the administration of skilled and impartial agencies of the Federal Government, controlled not locally nor sectionally, but by all of the people?

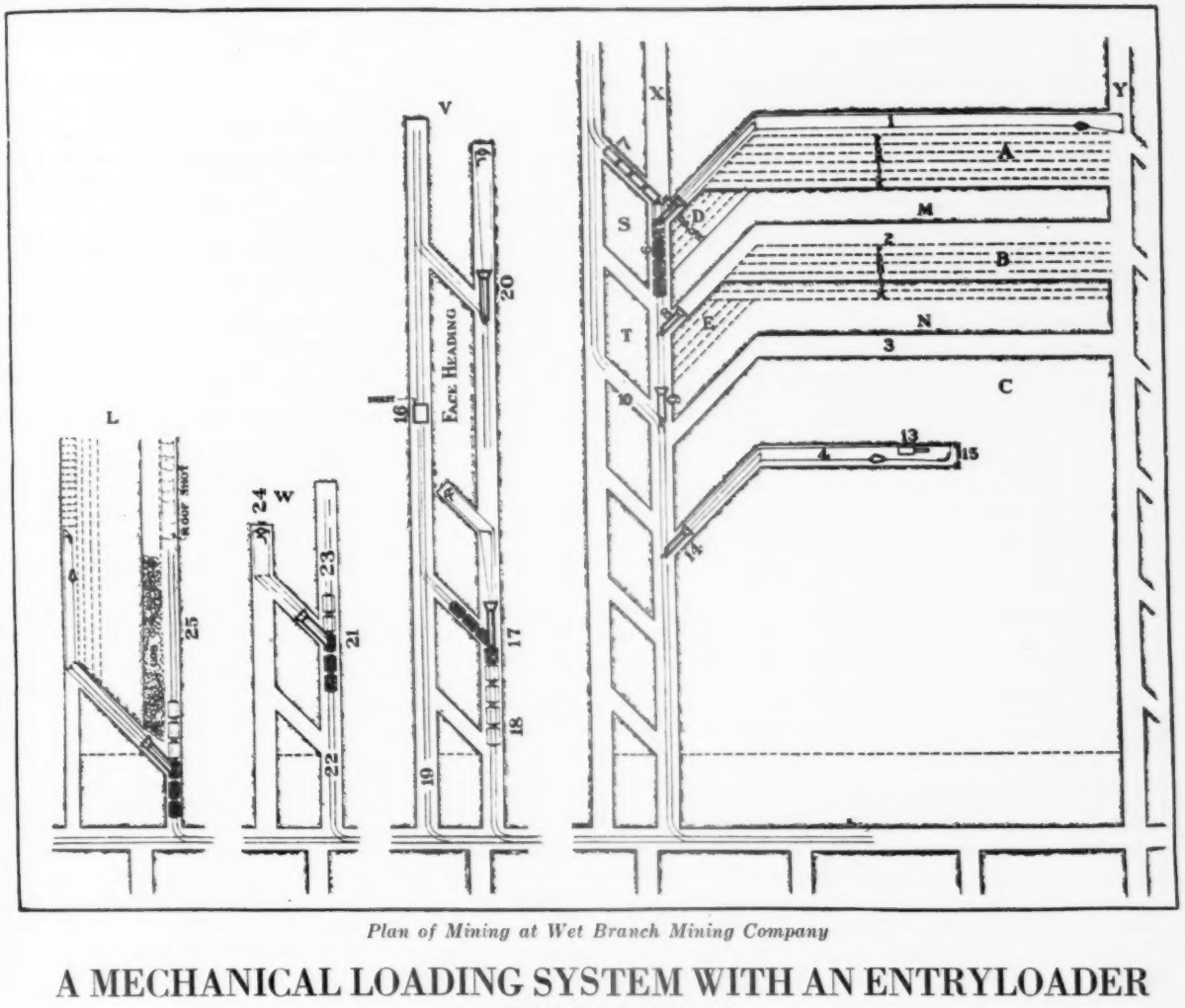
CASE FOR HYDRAULIC MINING

(*Continued from page* 758)

The advantages to the farmer far exceed those given to the miners by this plan. Nevertheless, the rejuvenation of hydraulic mining in the mountain counties will result in the restoration of vigorous life to the entire region affected. Towns that have been almost evacuated will again be busy, the buying power of the mountain counties will be greatly increased, and the whole state will reflect the prosperity.

At the last session of Congress the writer secured legislation directing the California Débris Commission, created under the Caminetti Act, to prepare a report for the Seventieth Congress, showing the status of the hydraulic mining industry, to furnish plans and surveys of dam sites for restraining the débris from hydraulic operations, and to make recommendations as to any necessary changes in the Caminetti Act to meet with present mining conditions. Also to review the report recently made by the California State Mining Bureau, and recommend what portions of the expense of the plan for the resumption of hydraulic mining should be borne by the Federal Government and what portion by the state.

This report to the next session of Congress by the California Débris Commission will be the basis of legislation to provide appropriations for the construction of the dams necessary for the resumption of the hydraulic mining industry and also necessary for the protection of the valley regions from floods and from the natural erosion which is at present continually filling the channels of the navigable rivers.



Plan of Mining at Wet Branch Mining Company

A MECHANICAL LOADING SYSTEM WITH AN ENTRYLOADER APPLICATION

Scraper Loader Developing Entries, Advancing Rooms And Slabbing Pillars—Descriptions Of Operating Methods—Number Of Men Employed—Mining Costs And Tonnage Produced—High Pillar Recovery Made

THE following method of working is in use by the Wet Branch Mining Company, in coal ranging from 38 to 40 in. thick at Dry Branch Station, on the Chesapeake and Ohio Railroad, in Kanawha County, W. Va. (See Plan of Mining above.)

With a type 136 Goodman Entryloader, the following equipment is used:

One Shortwall mining machine for the purpose of undercutting the coal.

One Power drill for the purpose of drilling and shooting the coal.

One Blower for the purpose of conducting air from the face headings, lettered as X and Y, into the faces of narrow rooms 1, 2, 3 and 4; this air to ventilate for the men at the face who are driving these narrow places.

One Hoist mounted on a truck, which will be described in detail later.

Where the slate is too hard to readily drill by hand, a power drill will be used. This will help in speedily loading out the rock described in this article in position 23.

Method of Operation

The method of operation is as follows:

The Entryloader is placed in the neck of the narrow room No. 1. This position of the Entryloader is represented by the numeral 5 in the above plan.

Rooms 1, 2, 3, 4, etc., are driven up 10 feet wide.

After Room 1 is driven from heading X to heading Y, panel A is started to be developed.

Undercuts F, G, H, I, J and K are made and loaded out, following two procedures which are set forth below:

(1) Narrow place No. 1 is advanced by using Entryloader at position 5, with two shifts, four men on each shift; one man to operate the machine and three men at the face to cut and load the coal.

When room No. 1 is advanced from heading X to heading Y, undercut F is made on the night shift, with four men cutting, drilling, shooting and posting. Four men, three on the face and one on the loader, on the day shift, operate the machine at position 5, loading out the coal. The total operation is composed of eight men

who undercut and load out undercut F in a period of eight hours.

It will be noted that the cars, represented by position 6, go through cross-cut represented by No. 7, into the back heading of face heading X.

(2) The other method would be that all eight men work on the day shift, assuming that undercut F is made, the coal shot down and the place posted ready for the beginning of the shift. The cutting machine is then dragged back to the face at the end of heading Y.

As soon as the loader cleans up the back end of cut F, the machine follows behind the loader cutting cut G.

The men operating the cutting machine cut the coal, drill the holes, shoot the coal, and do the posting as they are following behind the loader as fast as it cleans the face.

This operation is repeated until all of the undercuts F, G, H, I, J, and K have been loaded out.

When the room represented by A has been advanced by undercuts to where the top becomes heavy, the machine is transferred to room No. 2, position No. 8, and the operation is repeated.

Room No. 1 has now been changed to panel A, with sufficient rib M between panel A and proposed panel B; this rib being of sufficient thickness to break the top represented in the area panel A.

Panel B is shown partly completed to the heavy line. Cuts J and K have not yet been taken off. When cuts J and K are taken off, the pillar will be represented by N.

While room No. 3 has been cut through between face headings X and Y, room No. 4 is not yet cut through. Panel C, therefore, is not completed and ready to be extracted.

The stump in panel A, represented by D, has been left on. The stump in panel B, represented by E, is also left on.

After the break has occurred in panel A, and the coal has been extracted in panel B, the machine can be located on the straight track represented by position 9, with cars to be loaded going through cross-cut No. 10, and panel stumps D and E are extracted, represented by cuts O, P, Q and R. Stumps represented by S and T in the heading are abandoned in order to protect the panels in the next heading.

If it is contemplated to recover heading stumps, three entries could be driven and these stumps recovered later from the center heading. The same operation can be repeated for stump E in panel B.

If rooms 1, 2, 3 and 4 are driven up 10 feet wide and the coal is 3 ft. 3 in. high, and is undercut to a depth of 6 ft., this undercut will produce approximately 8 net tons of coal.

If the distance between face headings X and Y is 300 feet, undercuts F, G, H, I, J and K will average at least 200 net tons of coal per undercut.

If rooms 1, 2, 3 and 4 are developed with the scraper loader, by the use of four men as described, not less than four undercuts should be obtained and loaded out in a day of eight hours.

Calculate the four men's wages and divide this into 32 net tons and it will give you the payroll cost of the coal on the pit car driving the narrow work.

Calculate the wages of the eight men on undercut F and divide it by 200 tons and it will represent the payroll cost per ton of the coal on the pit car.

The width of panel A and the number of undercuts obtained will be dependent entirely on how the top acts in each individual case. Due to the speed of extraction, the minimum width of panel A will be not less than 50 ft., and at the present time we have successful operations of 80 ft.

If the narrow room represented by figure 1 of panel A is 10 ft. wide and the total of panel A is 70 ft. wide before the top shows weight and the work is to be discontinued, this would show the ratio of the coal in the narrow room 1 and panel A as 1 and 6, that is, one-seventh is represented by the payroll cost of the coal for one ton on the pit car as narrow and six-sevenths on the pit car at a cost per ton from the wide work or an average of a total cost per ton for the total of the panel, as per the following example:

Driving up narrow work, the wages of four men at $7.50 per day would be $30.00 per day.

Eight tons per undercut, and four undercuts per shift, would be 32 tons of coal for $30.00.

Or a cost of coal in driving Room No. 1 for narrow of $.94 per ton.

The wages of eight men at $7.50 per day would be $60.00 per day.

Two hundred tons of coal per day for $60.00 would be $.30 per ton.

With one ton costing $.94 and six tons costing $.30, the average cost per ton for the panel would be $.39 per ton loaded on the pit car.

In room No. 4 the cutting machine is represented by position 13. The three men at the face who use the cutting machine to undercut the coal and load the coal in the scraper are shown by position 15, while one man operating the machine at the neck of the room is shown by position 14.

In some cases the scraper is not taken around the deflector at the face, as shown in 15, but is carried in the middle of the place end on, and is loaded from this position without being turned sideways.

Sometimes when the panel is up more than 300 ft. the coal is brought down 100 ft. and left there, while the scraper returns to the men at position 15, who load the coal into the scraper, and it is carried back 100 ft.

After the coal in position 15 is loaded out, two men take the machine from position 13 and undercut the coal, while the third man guides the scraper where the coal has been deposited 100 ft. back, and this man and the man on the loading machine, position 14, load the coal out, while the two men are undercutting, drilling, and shooting the face at position 15. This is in order to save time and avoid delay on the long run of the scraper to the loading machine, and keeps the men at the face continually busy loading out the coal.

Recovering pillar stumps D and E would not cost materially in excess of the coal in panel A as these stumps are open-end and would cut and load out readily for about the same average cost as that of the panel.

In the operation of the scraper loader in panel A, it will be noted that because the scraper comes down along a new undercut each day, there would be no tendency to dig bottom as the scraper would have a new path to travel with each undercut.

In figuring the total cost of operation of loading coal on the pit car with this Entryloader, the interest, depreciation, power, powder, ropes, pit posts, repair parts for the machine, supplies for operation such as oil and waste, and also the labor of keeping the machine in proper repair amount to 18 cents per ton. The total cost of production of coal from panel A will be equivalent to the payroll cost of 39 cents per ton plus 18 cents or 57 cents per ton.

Compare with the cutting of coal in rooms, the loading of coal in rooms, the car pushing of coal in rooms, and the cost of pit posting of coal in rooms, and you will have the net saving between the two systems.

A good average percentage of extraction is 85 percent of the total in an acre of coal; 85 percent extraction of a seam of coal of an average thickness of 3 ft. 3 in. will yield about 4,400 tons of coal.

The system outlined above would produce a recovery of approximately 75 percent in a large number of the thin seams of coal now being operated.

Assuming that the coal in the ground was worth as much as $200.00 per acre, and 4,400 tons is a good percentage of recovery with the old system of room and pillar operation with hand loading, the coal in the ground will have a depletion value of $.045 per ton.

With the above outlined system of mechanical loading a 75 percent recovery represents 3,800 tons per acre. There will be a loss of 600 tons to the acre, which at $.045 per ton, will represent a

loss to the operator of unrecovered coal of $27.00 per acre, or on 3,800 tons of coal there would be an additional cost of $.008 per ton in the system of mechanical loading as against the old room and pillar system with hand loading.

With the concentration effected in the ventilation and haulage by the use of this system, and the difference in the cost of haulage in favor of this system, as compared with the room and pillar system, an additional earning would be shown.

Earlier in this article reference was made to the use of a hoist for the purpose of handling the loaded trips. The plan shows the face heading represented by V, at position 16. Position 16 represents a single drum hoist of 5 h. p. capacity, with 200 ft. of rope on it; the hoist being built for a rope travel of 20 ft. per minute. This hoist is mounted on 8-in. wheels in order to keep it low so that it will go into 3 ft. 3 in. of coal without any of the heading being brushed.

The control of this hoist is handled by having a portable controller, which is located at loading machine, position 17. This portable controller at loading machine, position 17, is connected to the motor of the hoist at position 16, by a flexible cable. This hoist is capable of handling 25 cars holding 2 tons of coal.

The cars at position 18 are connected to hoist at position 16, by a steel cable represented by dotted line.

Cars are dropped in below the loading machine, position 18, by the locomotive. The operator at position 17 loads the first car with coal. When he desires to shift the car along he operates the portable hoist controller, which starts the hoist at position 16, which is connected to the trip of cars with one-half-in. steel rope, these cars being represented at position 18. The loaded car is then moved along and the next empty car is brought under the loading machine and loaded. Hoist 16 is held in position by two screw jacks against the top.

When all of the cars have been loaded out and pulled into the back heading against hoist 16, the motor drops into back heading represented by position 19, and pulls out these loaded cars. After more empties are placed in position 18, the rope is connected to the empties, and the cycle is repeated.

Hoist 16 is mounted on a truck having 8-in. wheels, it is readily portable from one position to another and it is always ready for operation.

Cross-cuts are driven through on a slant of 45 degrees in order that rope may readily pull the cars without the use of sheaves on the corners of the rib. Headings V and W show the various positions in using the Entryloader for developing cross-cuts and the headings.

Referring to face heading V, see position of loading machine No. 20. When the heading has been driven 300 ft., machine is shifted to position 21, heading W, and the back heading is driven up. Cars are brought in along the track, position No. 22, track having been laid ahead of the machine, represented by position 23, to the full distance of developed heading, position 23, which, as stated, is 300 ft.

Enough cars are dropped into position No. 23 to allow for loading out the back heading, position 24, and also enough cars are put to the face of the heading, position 23, to allow a crew of men to start to drill the rock and shoot down the top in brushing the roof. As fast as this rock is drilled and cleaned up, these cars are pushed back against the loaded coal cars which have been brought through as empties from position 23, and are loaded out at position 21 to position 22. These cars of loaded rock are shown in position 22.

This allows for developing heading, position 24, and shooting down rock, position 23, at one and the same time, so that by the time heading, position 24, is developed 300 ft. all the rock is shot down in the heading of position 23. The machine is then moved up and the cycle repeated.

On the plan, L represents the gob heading driven with a scraper loader. The straight heading would be driven as in heading V, position 20, described above. It would be at first driven up narrow 10 ft. wide and then three slabbing cuts, 300 ft. long, brought back, after which the rock is shot down as represented by No. 25, showing the rock put in the gob.

The back heading is driven the same as in heading W, position 21. It is driven up narrow, 10 ft. wide, and three slabbing cuts are brought back, each 300 ft. long.

The slabbing cuts produce cheap coal and materially reduce the cost of driving the headings. It might be said, however, that it takes good top to stand the use of gob headings in connection with the use of panel rooms, as shown in panel rooms 1-A, 3-B and 3-C. The reason for this is that where the machine stands in position 5 and position 8, there would be too much space, which would cause caving unless the top was exceptional. Only in special cases can a gob heading be used.

The same may be said of a wide back heading, where the back end of room A on heading Y would have such a great space that undercuts H, I, J and K would leave too much of an open space in the back end of room A, causing either cribbing or excessive posting, together with other difficulties.

The success of operation of this plan of procedure depends upon the management of the mine, revolving around—

(1) The precision and accuracy of the surveying with relation to the straightness of the face headings and the degree of accuracy with which the cross-cuts are turned at the angle of 45 degrees and the degree of accuracy with which the narrow rooms represented by figures 1, 2, 3 and 4 are turned at an angle of 45 degrees and then turned again at an angle of 45 degrees at the turn.

(2) The accuracy and quality of the laying of the track. With this in view, frogs, switches and turns should be built up on steel ties so that they can be taken apart and put together with accuracy. They will then assemble in the original position.

(3) The quality of maintenance of the equipment, including inspection and facilities for making immediate repairs and having a staff on duty so that this can be done. The equipment must be inspected and always kept in shape to make an eight-hour run. These pieces of equipment include—

One Entryloader with an abundance of rope cut to the right lengths, which can be put on immediately.

One Shortwall cutting machine.

One blower and an abundance of canvas hose to carry the air.

One portable drill to drill the coal.

One gathering locomotive to gather the coal and to shift empties.

If any part of this equipment is not properly inspected and kept in proper shape and repair, it will cripple the entire system, resulting in loss of tonnage and material increase in the cost of production.

(4) A sufficient amount of empties must be available through organization of the haulage so that the loading machines are never idle.

(5) There must be delivered at all times an adequate supply of posts so that panels are never delayed in their posting.

(6) Good ventilation should always be kept in the face and butt headings so that an abundance of fresh air is available for the blowers in order that the smoke from shooting may be readily removed in the narrow room as well as in the panel work. This will provide against delays in loading.

(7) Adequate voltage should be supplied, as the speed of the loading machine to load the tonnages given is based upon full voltage at the machine. If the voltage is low, the speed of the scoop is lowered, and tonnages can not be produced, thus increasing the cost of production. Low voltage also affects the speed of cutting and hauling.

COAL WASHING—SOME FACTORS IN THE PROBLEM*

Importance Of Screen Analysis To Determine Washability—Solutions Used In Sink-And-Float Tests—Curves Showing Test Data—Wet And Dry Cleaning Methods For Coal Discussed—Washing Costs Outlined

By JAMES R. CAMPBELL †

IN my previous writings on the subject I have pointed out the importance of making a survey of the feed or raw coal by screen analysis and "sink and float" tests on the different fractions. Lately most investigators set up the "sink and float" data in the form of washability curves. (See figures 1, 2, 3, 4, 5, 6 and 7.) By such data the operator is able to predict within a reasonable degree of accuracy the results that may be obtained by any efficient washing apparatus.

As to the sizes to be examined it is quite optional to the investigator. The range is from 3½ in. or 4 in. to 0 in. The size above 3½ in. or 4 in. is usually beyond the range of the ordinary washing apparatus, and is best cleaned by some other method, usually hand picking. A convenient system of screen analysis is as follows: 3½ to 1¼-in.; 1¼ to ½-in.; ½ to 5/16-in.; 5/16 to 14 m.; 14 m. to 28 m.; 28 m. to 48 m.; and frequently for complete data 48 m. to 100 m.; 100 m. to 200 m.; and through 200 m.

Sink and float tests at the different gravities are usually made on all fractions down to 48 mesh and a composite calculated. It is possible to run sink and float tests on minus 48 mesh material but this is usually in such small amount as to be negligible. This system of examination is exhaustive and conclusive. We refer particularly to washing the 14 mesh to 48 mesh material by gravity methods. The older method was to stop at about 20 mesh.

The solutions used in "sink and float" tests are as follows: Zinc chloride, calcium chloride, carbon tetrachloride, bromoform and possibly others. The last two named are very convenient as they can be thinned down with benzol or gasoline. The carbon tetrachloride can be used for the gravities below 1.60 and bromoform above.

The range of gravities in testing is usually from 1.30 to 1.90, the former for the inherent ash and sulfur in the coal and the latter to determine the character of the rock end. A sufficient number of gravity fractions should be made to determine the intermediates, especially the middling product which is oftentime very troublesome.

The washability of the coal under examination is directly determined by the washability curves set up from the sink and float data. Sharp "breakes" in the curves tend to show a good washing proposition. An important factor in determining the washability of a given coal is the effect of crushing in liberating the impurities. This is especially true in metallurgical coal.

From a study of the washability curves from the different coals in Central and Western Pennsylvania, in which coke oven men are most interested, I find that the lower productive measures are generally more amenable to ash and sulfur reduction than the No. 8 or Pittsburgh

* Presented before the annual meeting of the Eastern States Blast Furnace and Coke Oven Association, Pittsburgh, Pa., June 4, 1927.

† American Rheolaveur Corp., Scottdale, Pa.

Page No. 4

Report of Tests made on Bituminous Slack Coal From Modern Colliery

Progressive Coal Company.

1. Sampling and Peculiarities of Sample:-

Whole sample screened over 1/2" diameter. Each portion mixed and quartered separately one time.

One half of the part over 1/2" and one half of the part under 1/2" used in the test.

2. General Data:-

Date Sample Taken or Received:- July 31,1926

Total Weight of Sample:- 87.8 Kgs.*

Moisture %:-

Volatile Matter %:-

Fixed Carbon %:

Sulphur %:-

*193.5 Lbs.

3. Sizing Tests:-

Denomination	Weight Kgs.	% Weight	% Ash	% Sul.	Wt. % of Feed
Over 1/2"	18.80	42.6	12.5	2.40	42.6
Thru 1/2" Over 1/4"	7.16	16.3	11.3	1.95	16.3
Thru 1/4" Over 1/16"	7.46	17.0	11.9	1.96	17.0
Thru 1/16" Over 28 mesh	5.54	12.6	13.5	2.17	12.6
Thru 28 mesh Over 48 mesh	1.92	4.4	15.6	2.86	4.4
Thru 48 mesh	3.12	7.1	18.4	2.63	
Total	44.00	100.0			
Average			12.9	2.26	
[illegible]					
[illegible]					
[illegible]					
[illegible]					
Fraction Thru 48 Mesh					
thru 48 Mesh over 100 Mesh		34.9	20.1	3.51	8.5
thru 100 Mesh over 200 Mesh		18.0	19.3	3.01	1.3
thru 200 Mesh		47.1	16.9	1.84	3.3
Total & Average		100.0	18.4	2.63	100.0

*14 Mesh is equivalent to 1-16" round hole screen.

Page No. 5

Test Made on Bituminous Slack Coal Sample dated July 31st, 1926.

Modern Colliery Progressive Coal Company

4. Float and Sink Tests: ASH TEST

Size : Over 1/4"			Size: 1/4 - 1/16"		
Curve No. 130-B			Curve No. 130-C		
Specific Gravity	Weight %	Ash %	Specific Gravity	Weight %	Ash %
Float 1.30	74.0	2.44	Float 1.30	74.3	2.00
Sink 1.30 ; " 1.40	7.5	9.02	Sink 1.30 ; " 1.40	6.6	9.80
" 1.40 ; " 1.50	2.8	15.40	" 1.40 ; " 1.50	3.4	18.30
" 1.50 ; " 1.65	3.0	26.00	" 1.50 ; " 1.65	3.8	29.40
" 1.65 ; " 1.85	2.5	39.20	" 1.65 ; " 1.85	1.8	42.60
" 1.85 ; "	10.4	73.00	" 1.85 ; "	10.1	72.60
" ;			" ;		
Total	100.0		Total	100.0	
Average		12.3	Average		12.0
Size: 1/16" - 48 mesh			Size:		
Curve No. 130-D			Curve No.		
Specific Gravity	Weight %	Ash %	Specific Gravity	Weight %	Ash %
Float 1.30	71.2	1.99	Float		
Sink 1.30 ; " 1.40	5.8	10.60	Sink ; "		
" 1.40 ; " 1.50	4.0	17.60	" ; "		
" 1.50 ; " 1.65	3.7	29.70	" ; "		
" 1.65 ; " 1.85	2.1	42.50	" ; "		
" 1.85 ; "	13.2	70.90	" ; "		
" ;			" ;		
Total	100.0		Total		
Average		14.00	Average		

Sample test sheets

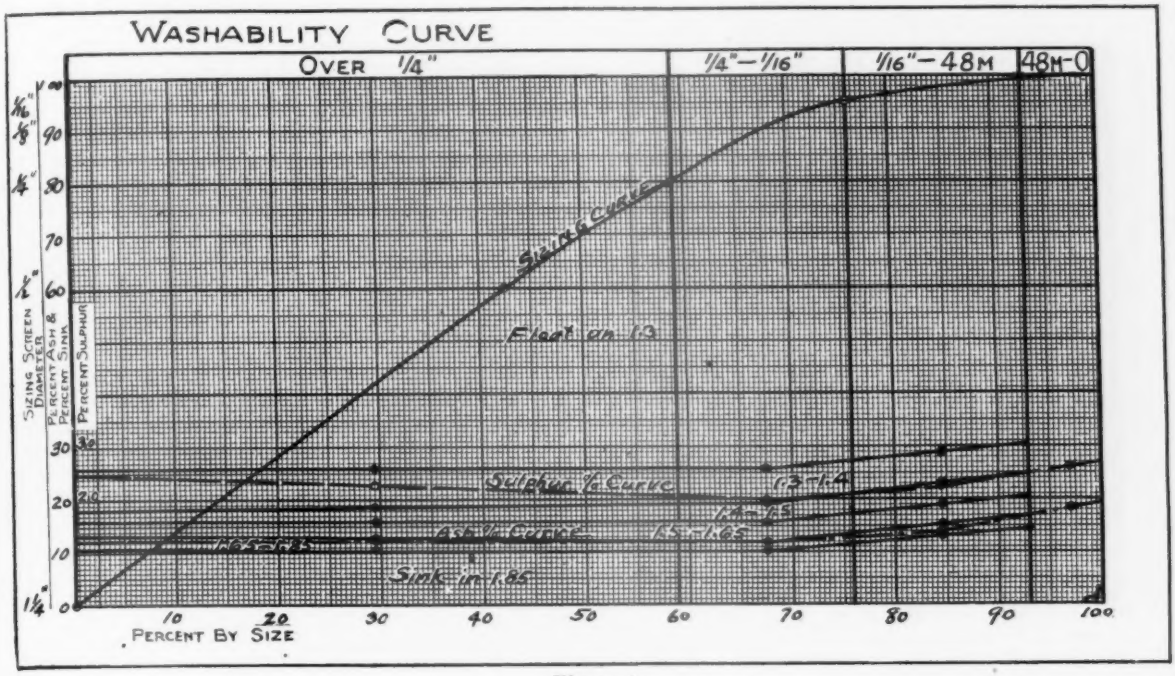


Figure 1

seam. The reason apparently is that the lower productive measures contain a larger percentage of free pyritic sulfur which is susceptible of removal. In the Pittsburgh seam the organic and pyritic sulfur is about 50-50, sometimes varying either way. Thus if coals like Greene County show 2.50 percent sulfur, it immediately becomes a pretty stiff washing proposition. On the other hand some of the lower productive measures show as high as 60 percent sulfur reduction, in which case a 3 percent sulfur is reduced to metallurgical quality, thus bringing within the pale immense acreages of potential coking coals when the famous Pittsburgh coal is exhausted. Efficient washing methods make them available now in certain districts. See Figures 8 and 9.

In the typical examination of slack coal by our system of setting up a washability report, shown in the context of this paper, the feed coal showed 12.9 percent ash and 2.26 percent sulfur. For fuel requirements, the washed coal without the minus 48 mesh material, amounting to 7.17 percent and analyzing 18.4 percent ash and 2.63 percent sulfur, showed a theoretical ash of 5.25 percent and sulfur 1.86 percent. The recovery was 83.02 percent, refuse 9.88 percent with 72.5 percent ash and 5.36 percent sulfur. Assuming that the minus 48 mesh material could not be improved by washing it would have to be calculated in with the washed coal. This would still give a good ash reduction and a satisfactory fuel with high recovery.

If the same coal were washed for coking purposes, without the minus 48 mesh, the theoretical washed coal showed ash 2.72 percent and sulfur, 1.29 percent; recovery 73.44 percent, refuse 19.46 percent with 50.50 percent ash and sulfur, 5.77 percent. Calculating in the minus 48 mesh with the washed coal the total sulfur becomes about 1.40 percent, with a recovery of 80.5 percent. In case the sulfur did not volatilize to 1 percent sulfur coke, the recovery would have to be dropped 2 or 3 percent. The curve shows that low sulfur is "in the wood." The ash, of course, is highly satisfactory.

A complete set of washability curves is shown based on the sink and float data. Left ordinates show recovery and abscissae the percent ash or sulfur and gravity of washing. The No. 1 curve shows theoretical washed products and the No. 3 the refuse end. We may say that the sulfur results are practically duplicated in practice, but a small increment for ash is allowed.

In special curves marked "A" and "B"

Bituminous
Test Made on Slack Coal Sample of ~~Washed~~ dated July 31st, 192-

Modern Colliery Progressive Coal Company

4. Float and Sink Tests' SULPHUR TEST

Size Over 1/4"			Size 1/4 - 1/16"		
Curve No. 130-BS			Curve No. 130-CS		
Specific Gravity	Weight %	Sulphur %	Specific Gravity	Weight %	Sulphur %
Float 1.30	74.0	1.22	Float 1.30	74.3	1.05
Sink 1.30	7.3	4.27	Sink 1.30	6.6	3.10
" 1.40	2.8	6.99	" 1.40	3.4	4.86
" 1.50	3.0	8.46	" 1.50	3.8	5.43
" 1.65	2.5	7.22	" 1.65	1.8	4.55
" 1.85	10.4	4.14	" 1.85	10.1	5.38
"			"		
Total	100.0		Total	100.0	
Average		2.27	Average		1.98
Size: 1/16" - 48 mesh			Size:		
Curve No. 130-DS			Curve No.		
Specific Gravity	Weight %	Sulphur %	Specific Gravity	Weight %	Sulphur %
Float 1.30	71.2	0.98	Float		
Sink 1.30	5.8	2.66	Sink		
" 1.40	4.0	3.04	"		
" 1.50	3.7	4.32	"		
" 1.65	2.1	4.00	"		
" 1.85	13.2	8.70	"		
"			"		
Total	100.0		Total		
Average		2.39	Average		

Sample test sheet

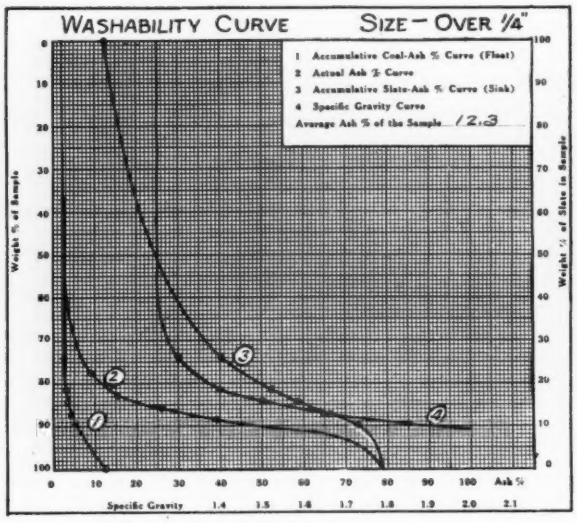

WASHABILITY CURVE SIZE – OVER 1/4"
1 Accumulative Coal-Ash % Curve (Float)
2 Actual Ash % Curve
3 Accumulative Slate-Ash % Curve (Sink)
4 Specific Gravity Curve
Average Ash % of the Sample 12.3
Weight % of Sample
Weight % of Slate in Sample
Ash %
Specific Gravity

Figure 2

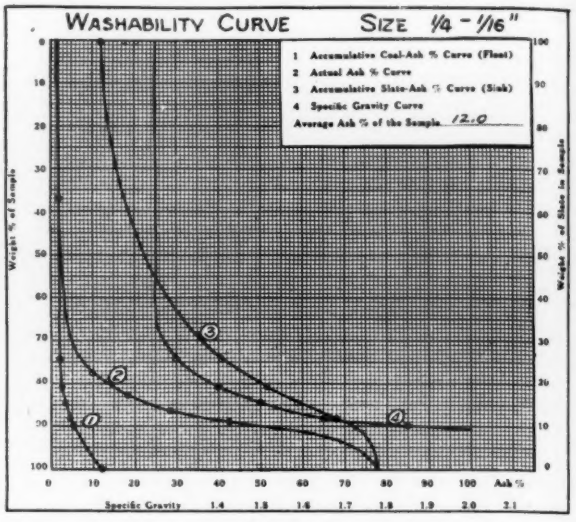

WASHABILITY CURVE SIZE 1/4 – 1/16"
1 Accumulative Coal-Ash % Curve (Float)
2 Actual Ash % Curve
3 Accumulative Slate-Ash % Curve (Sink)
4 Specific Gravity Curve
Average Ash % of the Sample 12.0
Weight % of Sample
Weight % of Slate in Sample
Ash %
Specific Gravity

Figure 3

the sharp "breakes" in ash and sulfur are perhaps better illustrated than in the regular curves already referred to. We call particular attention to the low ash and high recovery in curves "A" and the low sulfur in curve "B." Naturally these results could not be obtained if the ash and sulfur were not inherently low. This is a point that can be arrived at only by complete study of the coal in question. Practical tests do not usually bring out all the facts on the washability of any given coal and often lead to wrong conclusions. We must have the theory to get the practice right.

Methods of Washing

In this country there are two schools—the "wets" and the "drys," and they exist in coal washing. It is needless to say that I consort with the "wets," although in 1919 I wrote a paper for the American Institute of Mining and Metallurgical Engineers in which I pointed out that if an efficient and fast dry method were developed for handling unsized fines, say 5/16-in to 0-in., the washing and drying problem would be greatly mitigated. Such a dual system may yet be evolved.

Of the wet systems of washing the following is a partial list at least:

(a) Launder washers,
(b) Jigs,
(c) Wet concentrating tables,
(d) Tubs and cones,
(e) and various types of thickeners and classifiers.

I head the list with the launder washer because it is perhaps the earliest type known. The latest development of this type is the Rheolaveur, embodying the features of simplified rewashes, slate draw offs and a regulating product, which makes it fast and efficient. On larger sizes, 3½ to 3/64-in., an operating plant shows 150 to 200 tons per hour on a 32-in. launder. On fine sizes 5/16-in. to 0-in. the normal tonnage is 50 to 60 tons per hour.

Jigs are known to most of you and until recent years have done most of the coal washing in this country. The tonnages are quite high on certain types like the Foust and Elmore compartment jigs. In the South I have seen Elmore jigs handling 75 tons per hour with ease. Jigging fine coal presents some difficulties and for that reason considerable attention has been given in late years to wet concentrating tables for handling fines, especially for metallurgical purposes. I have seen the development along this line and at present there are some very creditable plants in this district. The Campbell bumping table in the Johnstown district has had a long and useful career washing two seams of the lower productive measures. The Deister-Overstrom table in the anthracite and the Deister machine table in the bituminous

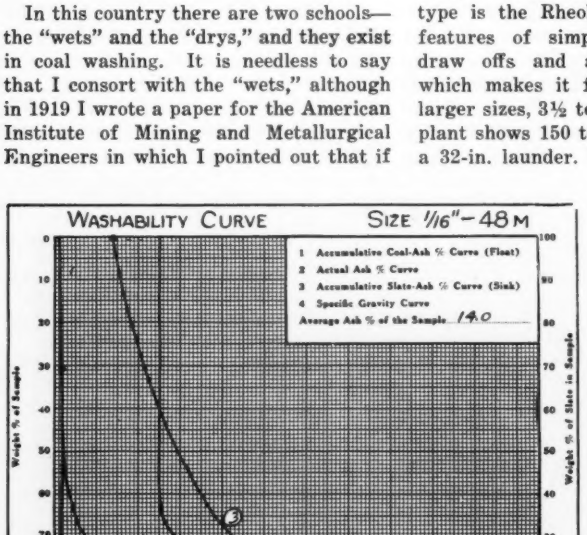

WASHABILITY CURVE SIZE 1/16" – 48 M
1 Accumulative Coal-Ash % Curve (Float)
2 Actual Ash % Curve
3 Accumulative Slate-Ash % Curve (Sink)
4 Specific Gravity Curve
Average Ash % of the Sample 14.0
Weight % of Sample
Weight % of Slate in Sample
Ash %
Specific Gravity

Figure 4

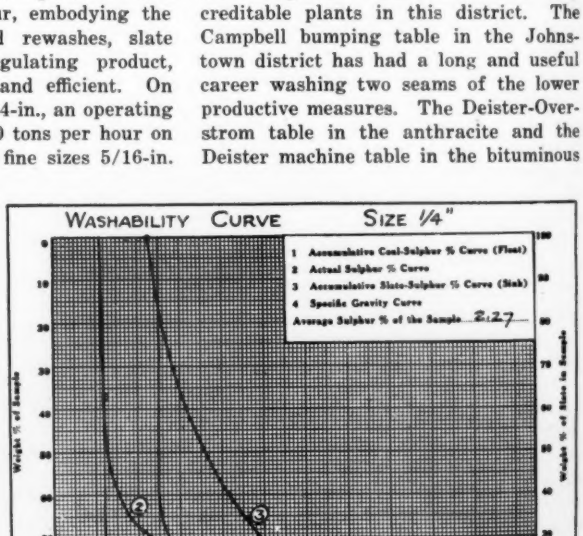

WASHABILITY CURVE SIZE 1/4"
1 Accumulative Coal-Sulphur % Curve (Float)
2 Actual Sulphur % Curve
3 Accumulative Slate-Sulphur % Curve (Sink)
4 Specific Gravity Curve
Average Sulphur % of the Sample 2.27
Weight % of Sample
Weight % of Slate in Sample
Sulphur %
Specific Gravity

Figure 5

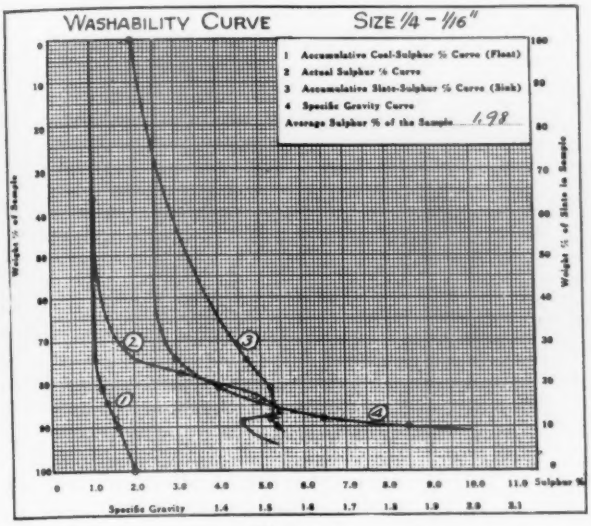

WASHABILITY CURVE SIZE 1/4 - 1/16"
1 Accumulative Coal-Sulphur % Curve (Float)
2 Actual Sulphur % Curve
3 Accumulative Slate-Sulphur % Curve (Sink)
4 Specific Gravity Curve
Average Sulphur % of the Sample 1.98
Weight % of Sample
Weight % of Slate in Sample
Specific Gravity
Sulphur %

Figure 6

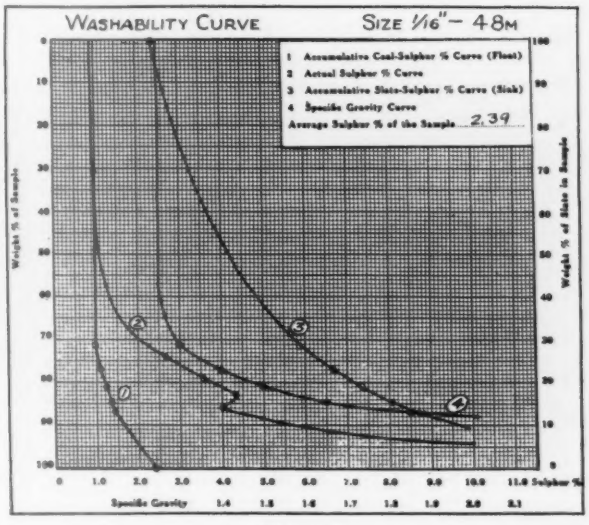

WASHABILITY CURVE SIZE 1/16" - 48M
1 Accumulative Coal-Sulphur % Curve (Float)
2 Actual Sulphur % Curve
3 Accumulative Slate-Sulphur % Curve (Sink)
4 Specific Gravity Curve
Average Sulphur % of the Sample 2.39
Weight % of Sample
Weight % of Slate in Sample
Specific Gravity
Sulphur %

Figure 7

region are doing good work and I should say are economical on small outputs. The chief draw back to concentrating tables is the low tonnage. I have seen a silt job in the anthracite field handling only ¾ ton per hour. However, the average is much higher. The Campbell table handles 4 to 5 tons per hour and other types run up to 7 to 10 tons per hour.

One concern has developed a table for handling large sizes of coal—say up to 4-in.—which it is claimed has a capacity of 12 to 15 tons per hour.

Any of the standard jigs and tables with the necessary rewashes will do a creditable job of washing. It is only a question of dollars and cents coupled with efficiency. I wish to speak particularly of the development of the old Robinson-Ramsay tub washer—the Chance cone with a fluid mass of sand and water as the so-called flotation medium. This washing job has had quite a wide application in the anthracite region where it has shown very good efficiency and high tonnage. The maintenance is high, however, on account of the sand handling equipment. This job does not handle the fines on account of sand troubles, hence has not thus far made much headway in bituminous coal washing.

Dry Cleaning

The usual methods of dry cleaning are —hand picking on belts, mechanical pickers and spirals, Bradford breakers and dry tables. We have already pointed out that on sizes above 3½ to 4-in., hand picking is practical and the accepted way of handling the situation. The Bradford breaker is a most useful and economical type of dry cleaning on certain coals and is a good crusher in addition where the product is further cleaned by wet washing.

The dry tables on the market, I believe, are off-springs of the old 3-S table in Dallas, Tex., which I investigated originally for the U. S. Steel Corporation and which is handled by the American Coal Cleaning Corporation. This concern has developed what is called the Y table and claim 30 to 40 tons per hour on the larger sizes. Roberts and Schaefer put out the Arms table exemplified in this district by the Windber and Montour No. 10 plants. The original Windber plant had 15 tables. The information I have is that 70 percent of the tipple output or about 2,400 tons is fed to the tables. Heyl & Patterson have a dry table job at Boswell, Pa., for the Davis Coal & Coke Co. consisting of 10 tables with a rated capacity of 165 tons per hour. Peale, Peacock & Kerr developed a dry table which is in use at their own plants.

In dry cleaning it is generally understood that in order to obtain the highest efficiency, close pre-sizing is necessary, due to the medium employed. The best ratio is said to be 2 to 1, but 4 to 1 is used. Much higher ratios can be used in wet methods. The dust problem has not been completely solved in dry plants that I have seen, but I believe a determined effort is being made to mitigate this trouble.

The air-sand flotation developed by Thomas Fraser deserves mention, though no plants are in operation. It seems to have latent possibilities and is like the Chance method.

Methods of Drying

In as much as the "wet" crowd have to become partly "dry" at least, we mention some methods of dewatering washed coal:

(a) Dewatering elevators and screens.
(b) Drainage bins and pits.
(c) Centrifugal driers, filters and presses.
(d) Direct heat driers.

Drainage bins and pits are old and quite satisfactory. The system used by the Bethlehem Steel Co. at Johnstown can hardly be improved on.

Considerable attention has been given to centrifuges for mechanical drying of washed coal. I mention the Elmore and the Wendell driers as early types. Perhaps the last word is the Carpenter drier, which is very efficient. This drier will handle fine coal and reduce moisture to approximately 5 percent with good capacity—about 100 tons per hour if there are not too many fines. The cost of drying is not excessive. The power is the big item. With a low power rate, say 6 or 7 mills per K. W., the total cost should not exceed 1½ cents per ton. At Pueblo, Colo., the cost is higher, due to a higher power rate.

It seems to me that all wet systems will have to improve on their drying methods. While I believe there is a lot of psychology in the hue and cry against wet coal at present, it behooves the wet washer man to face the issue squarely and give the coal consumer drier coal for his needs, whether it be for commercial use or for coke ovens. If the coke man wants 6 percent moisture coal or lower for his ovens let us give it to him and not argue about it, even if we have to take a second step in the drying process and use direct heat. If it is worth it, he will pay for it.

I figure that efficient wet methods of cleaning are here to stay, especially in metallurgical operations where sulfur is an important factor, and that more efficient drying methods will be developed as the art advances.

Efficiencies

The yard stick by which to measure the efficiency of any washing job is chemical analysis and "sink and float" tests. We end as we began. A 100 percent machine will remove all the impuri-

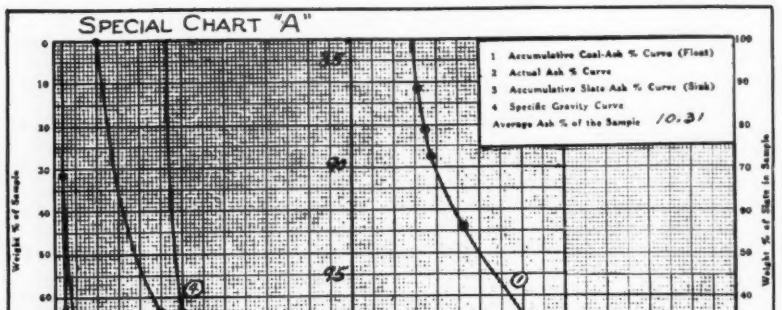

SPECIAL CHART "A"
1 Accumulative Coal-Ash % Curve (Float)
2 Actual Ash % Curve
3 Accumulative Slate Ash % Curve (Sink)
4 Specific Gravity Curve
Average Ash % of the Sample 10.31
ENLARGEMENT
Weight % of Sample
Weight % of Slate in Sample
Ash %
Specific Gravity

Figure 8

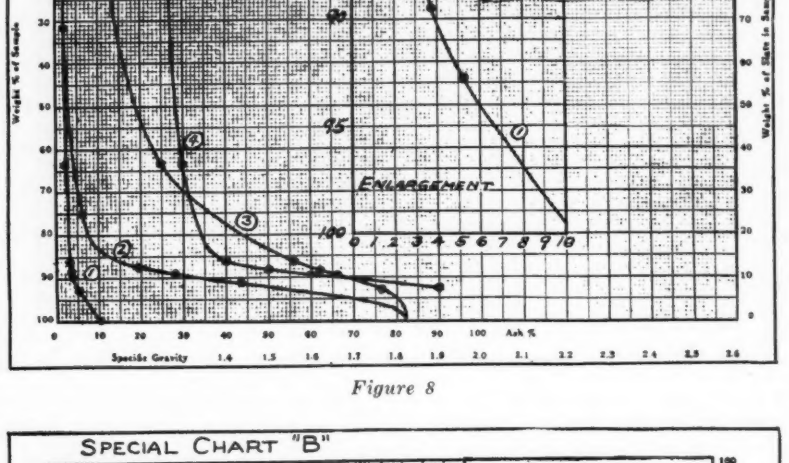

SPECIAL CHART "B"
1 Accumulative Coal-Sulphur % Curve (Float)
2 Actual Sulphur % Curve
3 Accumulative Slate-Sulphur % Curve (Sink)
4 Specific Gravity Curve
Average Sulphur % of the Sample 2.22
Weight % of Sample
Weight % of Slate in Sample
Specific Gravity

Figure 9

ties at the washing gravity with no loss of coal. Of course none of them do it but some approach the theoretical more closely than others. I have always advocated plant control by means of a Delatester or other good sink and float machine, in addition to chemical analysis. Efficiency of washing based on sink and float tests is determined by Drakeley's formulas, which are as follows:

Qualitative Efficiency

$$100 \times \frac{\text{(Washed coal float—feed coal float)}}{\text{100 — feed coal float}}$$

Quantitative Efficiency

$$100 \times \frac{\text{feed coal float} - \frac{\%\text{ refuse} \times \text{refuse float}}{100}}{\text{feed coal float}}$$

EXEMPLIFICATION OF FORMULAS

	% Ash	% Float 1.95 Sp. Gr.
Feed coal (100%)	16.12	90.00
Washed coal (88.4%)	7.68	98.76
Refuse (11.6%)	80.20	1.76

EFFICIENCIES BY DRAKELEY'S FORMULAS

Qualitative Efficiency

$$\frac{100\ (98.76 - 90.00)}{100 - 90} = 87.6\%$$

Quantitative Efficiency

$$\frac{100\left(90.00 - \frac{11.63 \times 1.76}{100}\right)}{90.0} = 99.76\%$$

An A-1 washing job should always show around 99½ percent quantitative efficiency if the total reject is not excessive—say around 10 percent. This means ½ percent coal loss in the refuse or what is known in the anthracite district as "bank loss." The bituminous operator is rapidly learning the term, in reckoning his costs.

WASHING COSTS

The direct cost of washing by any process is made up of four principal items, as follows: (1) power, (2) labor, (3) maintenance, (4) overhead charges.

The latter item includes depreciation and, as a good many figure it, interest on the investment. There is another factor in the cost of washing that must not be lost sight of. This is an item that knocks your eye out in some cases and both eyes out in others. I refer to an indirect cost caused by the "loss of input" or reject in washing—"conversion cost" is perhaps a good term. Thus, if the mining cost is $1.80 per ton and the reject in washing is, say 10 percent, the coal immediately costs $2 in the railroad car, adding 20 cents to the cost of washing over and above the 4 items named.

The other indirect cost item, I will refer to in a homely adage. You have heard that, "An extravagant wife can throw her husband's money out of the kitchen door with a teaspoon faster than he can bring it in the front door with a shovel." Some coal washers perform like that. They dribble away at the refuse end the profits of washing faster than the mine wagon can bring them in at the tipple.

In my long experience I have examined many washery wastes and it was a common occurrence to find 30 to 40 percent of float coal at the washing gravity. Even with a reject of only 10 percent by Drakeley's formulas the loss of market coal is high. In the above case we will say the quantitative efficiency is only 97 percent, indicating a "bank loss" of 3 percent. This coal has been processed and at least should be figured at the mine cost plus the cost of processing. I boldly say it should be figured at the sales value. If the market value is $2.50, the "bank loss" at 3 percent amounts to 7½ cents per ton. This is the second indirect item of cost that "knocks both eyes out." The anthracite operator recognizes this factor in coal cleaning more fully than the bituminous operator, therefore watches his "bank loss" like a hawk on account of the high market value of his product. Figure, if you please gentlemen, even 5 cents a ton "bank loss" on a 1,000-ton plant over a period of one year of 200 days—1,000 x 05 = $50, and 50 x 200 = $10,000 equivalent to the interest at 5 percent on $200,000.

It pays to have an efficient washing job just as it pays to have an efficient blast furnace or an efficient by-product coke oven. We perhaps don't want the "squeel of the pig" but we do want to keep our losses in coal washing down to the "irreducible minimum" as long as it doesn't cost any more money to do it.

In my opinion the coal washer of the present day is as justly entitled to good engineering and performance as the blast furnace and (*Continued on page* 778)

STORAGE BATTERY HAULAGE

Cost Of Storage Battery Operation—Direct And Indirect Savings—Elimination Of Trolley Wire —Battery Renewals—Safety In Gaseous Mines—Use Of Battery Locomotives To Increase

By W. R. YOUMANS*

ELECTRICITY is today considered the logical agent for transporting coal from the working face to the tipple, shaft bottom or foot of incline.

In considering just how electricity can best be used, two factors merit major consideration—Safety and Cost.

Doubtless storage batteries could with safety be used for supplying energy to locomotives in all mines. On the other hand, energy for a trolley wire can not be used with safety in all mines. Trolley wire power may therefore be considered non-essential, whereas storage battery power is essential.

It would be a very difficult and expensive experiment to demonstrate conclusively whether one system is more economical than another. It would require operation over a period of years and the development of each system to a state of maximum efficiency before *every* item entering into a comparative result tabulation would be considered.

It is possible to prepare figures representing cost items such as ordinarily make up the labor and material charges but the difficulty lies in estimating indirect cost effected by things which are not expected to happen but which too often do happen, such as personal injury and property damage resulting from contact with live wires or arcs from same, explosion of gas and coal dust and intermittent operation.

Mines are in operation where trolley wire is unknown. They are producing coal hauled by battery power at costs which meet the most severe competition from trolley hauled coal.

Until such time as the coal mining industry in general becomes organized, financed and operated in a manner comparable with other industrial enterprise, the use of one type of equipment or another will be very largely a matter of personal opinion rather than unbiased judgment supported by reliable data. Too often this personal opinion is influenced by experience with poorly designed equipment, equipment improperly applied or improperly used and where safety and the many advantages of storage battery locomotives were not accorded their merited recognition.

The effect of this unsettled condition on storage battery haulage is just this—A battery priced at say $4,000.00, and which should have hauled a possible 300,000 tons of coal during its period of service, gives out when it has hauled 150,000 to 200,000 tons of coal, and its cost is based on the latter figure. This would not be so serious if the battery had been depreciated monthly and a sum provided for its renewal, but this is generally neglected and it presumably costs the staggering sum of $4,000.00 to again put the locomotive in service. It is like the storekeeper who has sold out his stock, used the money, and then finds it difficult to restock.

On the other hand, with trolley operation the demand charge for reserved power plus the depreciation of trolley and bonding over the idle periods would probably have equalled the battery depreciation but this charge was paid monthly and the effect not so noticeable.

The above accounts for more discouragement with the use of storage battery locomotives than all other causes combined. It is no reflection on the usefulness, practicability and economy of the storage battery but rather a reflection on the management by the coal operator.

It is quite generally conceded that when used in gaseous mines the storage battery locomotive carries with it a factor of safety which makes it desirable regardless of whether its operating cost is lower or higher than that of the trolley locomotive.

Should this factor of safety not be considered when gas is not present? Or, is gas the only menace to safe operation which affects cost?

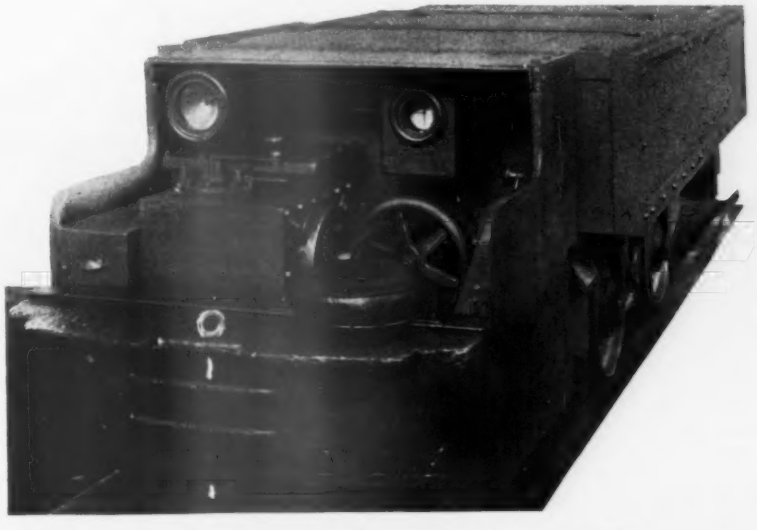
The use of the storage battery locomotive will increase in step with progress in the management and operation of mines and this progress will be in the direction of uniform safe operation at minimum cost.

Under average physical conditions but with such management as will be required from future coal producers, battery renewal or replacement cost will lie between 1 cent and 2 cents per ton of coal gathered or hauled.

Battery renewal cost is almost invariably presented as the chief obstacle to battery haulage equipment. Power costs and chassis maintenance are readily conceded to be lower than where trolley equipment is used.

Storage battery operation is therefore more economical than trolley operation unless the charge of 1 cent to 2 cents per ton for battery renewal is in excess of cost per ton for trolley wire, bonding and feeders plus the value of safe operation with storage batteries.

The Colorado Fuel & Iron Company has instituted a safety campaign by providing every miner in the company's employ with convenient first-aid kits. The kit comes in a small khaki box with the "C. F. & I." safety seal on the top. The contents of the box include a triangular bandage, swabs, compresses, pins, and mercurial dressings. It is believed these kits will do away with infections arising from small uncared for wounds.



A government-approved locomotive for operation in gaseous mines

* Engineer, The Ironton Engine Company, Ironton, Ohio.

METALS

PRACTICAL OPERATING MEN'S DEPARTMENT

GUY N. BJORGE, Editor

Practical Operating Problems of the Metal Mining Industry

PUMPING ACID MINE WATER

Precipitated Salts Quickly Delay Reduction By Usual Methods—Air Introduced To Solution And Constant Agitation To Prevent Clogging—Practically Complete Elimination Effected—Tar-Coated Wooden-Lined Pipes Used

By C. C. GREENWOOD*

PUMPING acid mine water at Cananea mines began with the first water encountered at the ore deposits, with the acid content increasing as the mine has developed and admitted air to the ore piles. Most of the ore bodies extend to or near the surface; consequently the surface is broken above the mined area, and this gives the seasonable water access to old stopes which contain much copper and iron sulfate. Water draining through such territory will be highly acid, and will cause much trouble to pumping equipment unless some reducing agent is employed before the water reaches the pumps.

REDUCING ACID IN MINE WATER

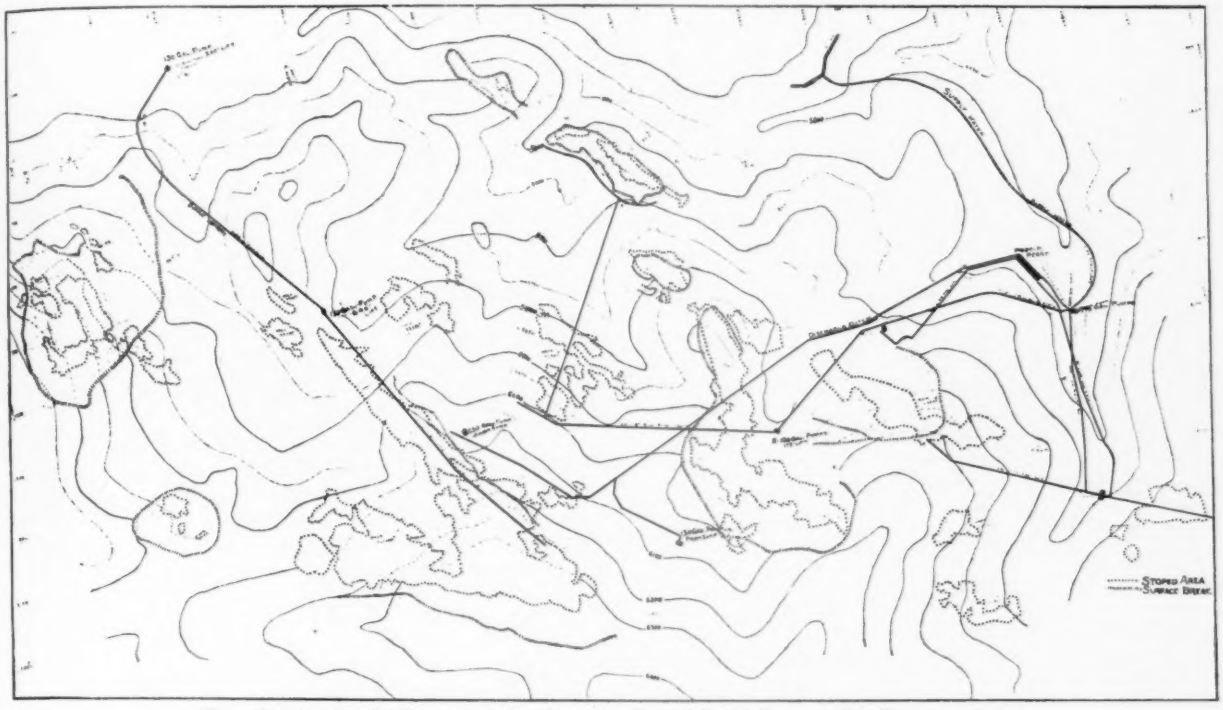
In the Capote No. 15 mine much acid mine water accumulated which had to be discharged at the surface, and, in order to neutralize the acidity, the water was taken through launders and cement tanks which were filled with scrap iron and lime was introduced. This method of treatment reduced the acid in some measure so that pumping could be accomplished without destruction to equipment, but the iron in the tanks and launders soon coated with scale and the tanks filled with precipitated salts. This prevented the proper action, as the contact between the iron and acid was destroyed, and as it required too much expense to clean and attend to the launders this method was discontinued. In its place raises were filled with all manner of scrap iron, and the mine water was made to flow over this iron. This gave much better results, as the iron did not coat so badly, nor did the mud accumulate as in the boxes. With a little attention this method has proved satisfactory, and if the copper content of the solution is important, considerable copper will be recovered.

When intentional leaching of old stopes was considered, the Capote 15 mine was selected for the experiment, as the pumping equipment there was capable of handling the excess water flowing from this source. In order to precipitate the copper and deliver the water to pumps in a neutral or near neutral state, boxes of 100-cu. ft. capacity were built at convenient points where the water could flow through as it drained to pump-sumps on the lower levels, and one tank was placed on the same level with the pumps to remove the last traces of copper and completely reduce the acidity. As constant contact between the iron and acid was necessary, air was introduced in the tanks to agitate the solution, thus preventing the concentration of accumulated salts in the boxes and keeping the iron clean. This produced a clean cement copper, and discharged a neutral tail water. By placing the last boxes close to the pumps so that the water flows only a short distance into the sumps, it was found that very little change took place in the iron. The Capote pumps have handled from the precipitation plants as much as 75 gallons per minute of acid water treated in this manner, with a resulting complete depletion of free acid, and reducing from as high as 10,000 parts per million ferrous iron to a trace of ferric sulphate. This operation covered many months without trouble from pumping equipment. At present no active leaching or precipitation is going on at the Capote, and to care for the small flow of acid water present one box of 100 cu. ft. capacity, filled with scrap tin or de-tinned iron, is placed on the station just ahead of the pumps. Boxes of this type require very little attention, and when the precipitate raises so that the air will no longer agitate the water, they are cleaned without other labor than that required for loading.

PUMPING EQUIPMENT

Capote mine-pumping equipment consists of two units. The lower unit, on the 1,600 level, is made up of three horizontal centrifugal pumps, each with a capacity of 500 gallons per minute. The water ends of all have been equipped with acid-resisting bronze which is cast

* Supt. of Precipitation Dept., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.



Map showing leachable areas, the Cananea Consolidated Copper Co., Sonora, Mexico

in our plant. The bronze is composed as follows:

Cu. %	Sn. %	Pb. %	Metallic phosphor
74.25	11.50	4.25	10

This composition has given very good results.

The upper unit, on the 1,200 level, consists of one 6½-in. by 14-in. triplex pump of 300 gallons per minute capacity, and three 5½-in. by 12-in. twin duplex pumps of 300 gallons a minute capacity. All water barrels and connections are of acid-resisting bronze.

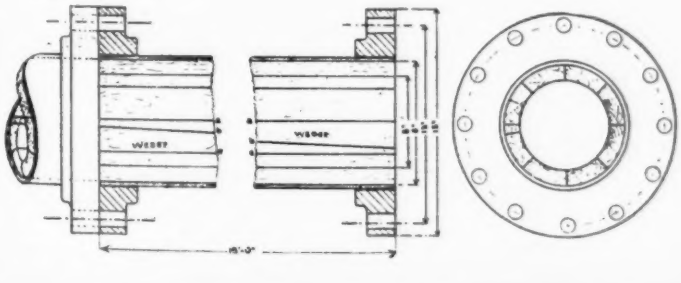
The water is pumped through two 8-in. water columns of reinforced wooden pipe. Wooden pipe reinforced with wire does not give satisfactory results when pumping against a very great head, as the pipe expands and contracts with each stroke of the pump, and leaks develop which destroy the steel hoops. Good results have been obtained by using wooden pipe inside of standard iron pipe. The pipe is first given a good coating of tar inside and out, and the staves of red wooden pipe are then put inside and wedged into position by two wedges driven from the opposite ends of the pipe, as shown at the bottom of the page. Fresh tar is forced into cracks between the wooden pipe to make it waterproof.

At the Veta Grande mine 70,000 gallons of very acid water are pumped each day. A 6-in. by 9-in. triplex pump of 175 gallons per minute capacity handles this water against a 300-ft. head. This pump was equipped with bronze water barrels and connections about two years ago and all of these are still in good condition. We have had very little trouble with this pump, although some lost time shows in our record for replacing valves, valve springs, and valve seats. The water columns are reinforced wooden pipe as shown in the figure, and outside of a few leaks we have had no trouble from these lines. The acid water in this mine is held behind cement bulkheads built to retain the water for at least 36 hours. With this measure of safety we are able to make our pump repairs without danger of flooding the mine with acid water.

The following tabulation of water analysis shows the character of the water handled at this mine for the 10 months covered by the record.

RECORD OF VETA PUMP WATER ON 300-FT. HEAD

No. of Tests	Month-Year	Parts, Cu.	Parts, Fe	Parts, Pb	Parts Free Acid
30	July, 1925	4072	2334	1026	93
28	Aug., 1925	3721	2504	876	145
27	Sept., 1925	6217	3009	1465	132
23	Oct., 1925	5603	2363	1730	111
25	Nov., 1925	5782	1132	2478	181
26	Dec., 1925	4931	1088	2355	226
28	Jan., 1926	4712	1702	1738	192
27	Feb., 1926	4007	2331	1642	226
30	Mar., 1926	5144	2326	1046	198
29	April, 1926	3740	2427	1231	182
Average from 273 analyses		4792	2129	1558	169



METHOD OF PLACING WOODEN PIPE IN STANDARD IRON PIPE.

In pumping leach water from Veta precipitation plant to Veta 15 stope, Evans tunnel and to relay tank, two 5½-in. by 9-in. triplex pumps of a capacity

of 175 gallons per minute are used at the tanks. Smaller pumps are used at the relay station. Although this water is not very acid, we have used bronze fittings wherever possible. (See table below.)

At present there are 14 pumps handling acid or slightly acid waters. All of them have been equipped with

RECORD OF LEACH WATER PUMPED FROM PLANT

No. of Tests	Month-Year	Parts, Cu.	Parts, Fe_2	Parts, Fe	Parts Free Acid
27	July, 1925	85	6683	303	Nil
26	Aug., 1925	79	6359	431	Nil
25	Sept., 1925	47	9418	536	Nil
29	Oct., 1925	6	9258	379	Nil
28	Nov., 1925	26	9273	566	Nil
27	Dec., 1925	68	7942	838	Nil
29	Jan., 1926	10	7002	848	Nil
27	Feb., 1926	87	7246	781	Nil
30	Mar., 1926	105	7286	360	Nil
28	April, 1926	53	7060	432	Nil
Average from 276 analyses		56	7752	547	Nil

bronze water barrels and cast chilled steel pistons. Since we started using this bronze about two years ago we have not had to replace any of the water barrels. Much of the water pumped is not highly acid, but the water in Veta Grande and the Oversight mines is a very severe test for any acid resisting metal.

The leach water pumped from the precipitation plant to the broken sections of the various mines where leaching is carried on is handled with wooden pipes. Only a small amount of reinforced pipe is used where the pressure is great, as our trouble with such lines comes from the small leaks, where the fine spray soon destroys the wire wrapping. To get the best results from the water lines, the small leaks should be repaired as soon as they appear. Further trouble with the line comes from the iron that precipitates and clings to the inside of the pipe, and we have found that a line will fill within a few months if not watched. We clean our lines with a small round piece of iron fastened to ¾-in. pipe, by connecting this with other lengths so as to shove the mud out for 100 feet or more. It is best to allow a little water to run into the pipe while cleaning.

In the mines the water at some places is allowed to flow from one level to another through wooden pipes. In such lines we have the same precipitation of iron salts that cling to the inside of the pipes. To clean our lines of this scale we use a piece of iron pipe that will pass freely through the line; this is cut in many places around the outside surface and the cut pieces are raised so as to make a scraper. This scraper is 5 or 6 feet long and is connected to the hoisting cable and moved up and down through the pipe line until the mud is removed.

COAL WASHING—SOME FACTORS IN THE PROBLEM

(*Continued from page* 774)

the by-product coke oven. The three are closely linked and will form a notable triumvirate in the years that are at hand when the low sulfur coals are depleted and when lower ash coals are demanded for coking coals.

Effect of Washing

The immediate effect of coal washing is, of course, the reduction of ash and sulfur in metallurgical coal. This can be translated into dollars and cents by the blast furnace men. I do not have the temerity to enter into the whys and the wherefores. It is sufficient for me to say that the value placed on each 1 percent ash reduction in the coke ranges anywhere from 10 to 25 cents per ton of pig iron, depending upon the conditions. Mr. R. H. Sweetser, of the American Rolling Mills Co., is a strong advocate of low ash coal and has done pioneer work along this line. He is quoted in the literature on the subject very frequently. He told me in personal conversation that he has paid as high as 25 cents a ton premium for each 1 percent ash reduction in the coal or 75 cents a ton more on 3 percent lower ash; he also added that he thought he might have paid a little too much for the savings effected.

In inter-company business it is comparatively easy to figure a profit in coal washing, based on ash reduction if there is a substantial reduction like 3 or 4 percent in the coke. In commercial work where the washed coal goes on the market in competition with an unwashed product, it sometimes is quite difficult to justify the cost of washing, "Get enough to play ball with," as one president of a coal corporation expressed it. Many operators express themselves as being satisfied with a broadened market for the cleaned product.

Another effect of washing coal for coking purposes is shown in the improved physical structure of the coke. The cross fracture caused by pieces of slate are eliminated, the general cell structure improved, and blockier coke is produced. Even fine grinding, where intimate mixtures are made, does not eliminate the trouble caused by slate which becomes segregated in the coking mass and impairs the structure just as surely as the larger pieces. Slate has no coking qualities and its presence is highly objectionable. Low-ash coals, if they contain free slate, are just as amenable to washing as high ash coals. In fact we have made some studies of low-ash coals and first wondered why they needed washing from the ash standpoint. The operator soon cleared up the point by citing the "kicks" of the by-product man on the physical structure of the coke.

The man on the market with his by-product coal "goes up against it" harder than the inter-company operator who oftentimes takes the "jam it down your throat" spirit with his coke oven man. The independent coke oven superintendent can be more selective.

In conclusion, I make a special plea to the blast furnace and coke oven men, if you are not already doing it, to consider the matter of better preparation of your metallurgical fuel strictly on its merits. Analyze your problem carefully from a cost and saving standpoint, then go after your coal man for a cleaner and more uniform product. It will help you and it will help the coal washing fraternity.

Clean coal makes clean coke, clean coke makes clean pig iron, clean pig iron makes clean steel and clean steel makes a satisfied customer which is a valuable asset in these days of quality competition.

PRODUCTION OF GRAPHITE IN 1926

THE graphite industry on the whole was more production in 1926 than it was in 1925, according to a statement by the Bureau of Mines. The following statistics on production were collected in cooperation with the geological surveys of Alabama, Michigan, and Texas. The sales of natural graphite by producers in 1926 were 5,145 short tons, valued at $209,592, an increase of 480 tons, or 10 percent, in quantity, and of $113,231, or 118 percent, in value, compared with 1925. The increase was in the crystalline variety, amorphous graphite decreasing in both quantity and value. The 1926 sales of amorphous graphite amounted to 2,650 short tons (52 percent of the total graphite), a decrease of 886 tons, or 25 percent, compared with 1925. The value of the amorphous graphite in 1926 was $30,750, a decrease of 22 percent compared with 1925. The sales of crystalline graphite in 1926 were 4,989,200 pounds, valued at $178,842, an increase of 2,731,950 pounds, or 121 percent, and of $122,121, or 215 percent, compared with 1925. The quantity and value of crystalline graphite in 1926 were the largest since 1920.

The manufacture of artificial graphite in New York increased considerably—from 12,135,655 pounds in 1925, to 21,163,986 pounds in 1926, or 74 percent.

The imports of graphite in 1926 amounted to 16,166 short tons, valued at $921,233, compared with 17,768 tons, valued at $826,410, in 1925, a decrease of 9 percent in quantity and an increase of 11 percent in value.

THE HURLEY MILL, WATER SUPPLY AND POWER PLANT *

A Detailed Description Of The Milling Plant Of The Nevada Consolidated Copper Company's Chino Mines—The Various Sources Of Water Supply And The Power Plant At Hurley Outlined—Methods Of Tailing Disposal and Flotation Practice Described

By J. T. SHIMMIN†

THE mill and power plant of the Nevada Consolidated Copper Company, New Mexico Division, Chino mines, are located at Hurley, Grant County, N. Mex., at an elevation of 5,700 ft. above sea level and served by the Atchison, Topeka and Santa Fe Railway Company, a distance of 10 miles southwest of the mines.

The ore is received at the mill in trains of 28 railroad cars each. The cars are all steel, raised center, drop-bottom ore cars, and contain an average of 55 wet tons per car.

The coarse ore bins are served by three unloading tracks, each accommodating seven cars. The ore is dumped through 12 by 12 in. cross-rail grizzlies located under the tracks and discharged into two bins, one of 12,000 tons and one of 6,000 tons capacity. The ore from the coarse ore bins is drawn from the bottom by 60 apron feeders that feed three 34-in. belt conveyors, each conveyor serving one coarse crushing unit.

The coarse crushing department comprises three units, one remodeled unit placed in operation in March of this year, consists of:

1—7-ft. Symons cone crusher.
5—Hum-mer screens.
1—Chino vibrating screen.
1—Set of 72 x 20-in. Garfield rolls.
1—38-in. elevator.
2—Short conveyors.

The other two units are each equipped with:

1—No. 8 McCully gyratory crusher.
3—Chino vibrating screens.
1—Set of 72 x 20-in. Garfield rolls.
1—38-in. elevator.
1—Short conveyor.

The flow sheet of the remodeled unit is as follows:

The feeder conveyor delivers to a grizzly having 2½-in. openings; the undersize from the grizzly discharges on to a ⅝ x 1¼-in. opening Chino vibrating screen; the oversize of the Chino screen and the oversize of the grizzly is fed to one 7-ft. Symons cone crusher, operating at 230 gyrations per minute.

The undersize of the Chino screen is fed to one type 39, 4 x 5-ft. Hum-mer screen, equipped with ¼ x ¾-in. screen. The Hum-mer screen oversize joins the crusher product; the undersize, or minus ¼-in. material, is conveyed to fine ore bins. The product of the crusher and oversize of the Hum-mer screen discharges to one 38-in. elevator and is elevated to a surge bin. The ore is drawn from the bottom of the surge bin by rotary feeders on to 4 type 39, 4 x 5-ft. Hum-mer screens, equipped with ¼ x ¾-in. screen.

The oversize of the Hum-mer screens is fed to one 72 x 20-in. Garfield roll, the roll product is returned by short conveyor to the elevator, joining the original feed and remains in closed circuit with the screens and roll until it is crushed fine enough to pass the ¼ x ¾-in. Hum-mer screens.

The finished product from the coarse crushing department is conveyed to the fine crushing department by two 36-in. incline conveyors, from which it is distributed by means of two 26-in. shuttle conveyors and one 30-in. tripper conveyor to 12 cylindrical fine ore bins having an available capacity of 9,600 dry tons.

At the discharge of the inclines are located two electrical samplers which cut the streams every eight minutes.

The fine crushing and fine grinding department is divided into six individual sections. Five sections are each equipped with two sets of 42 x 16-in. Garfield rolls and one section with one 8 x 12-ft. rod mill. Each roll section has a capacity of 1,500 dry tons per 24 hours; the capacity of the rod mill section is 2,000 dry tons per 24 hours.

The flow sheet of each roll section is as follows:

The ore is drawn from two cylindrical fine ore bins by four apron feeders where 2.66 tons of water per ton of ore is added. The wet ore is elevated by one 38-in. bucket elevator to eight 3 x 4-ft. Chino vibrating screens equipped with 10 mesh, .032-in. screens. The oversize from the screens is fed to two sets of 42 x 16-in. Garfield rolls operating at 120 r. p. m.

The roll product joins the original feed at the boot of the elevator and remains in closed circuit until it is crushed fine enough to pass through the screens.

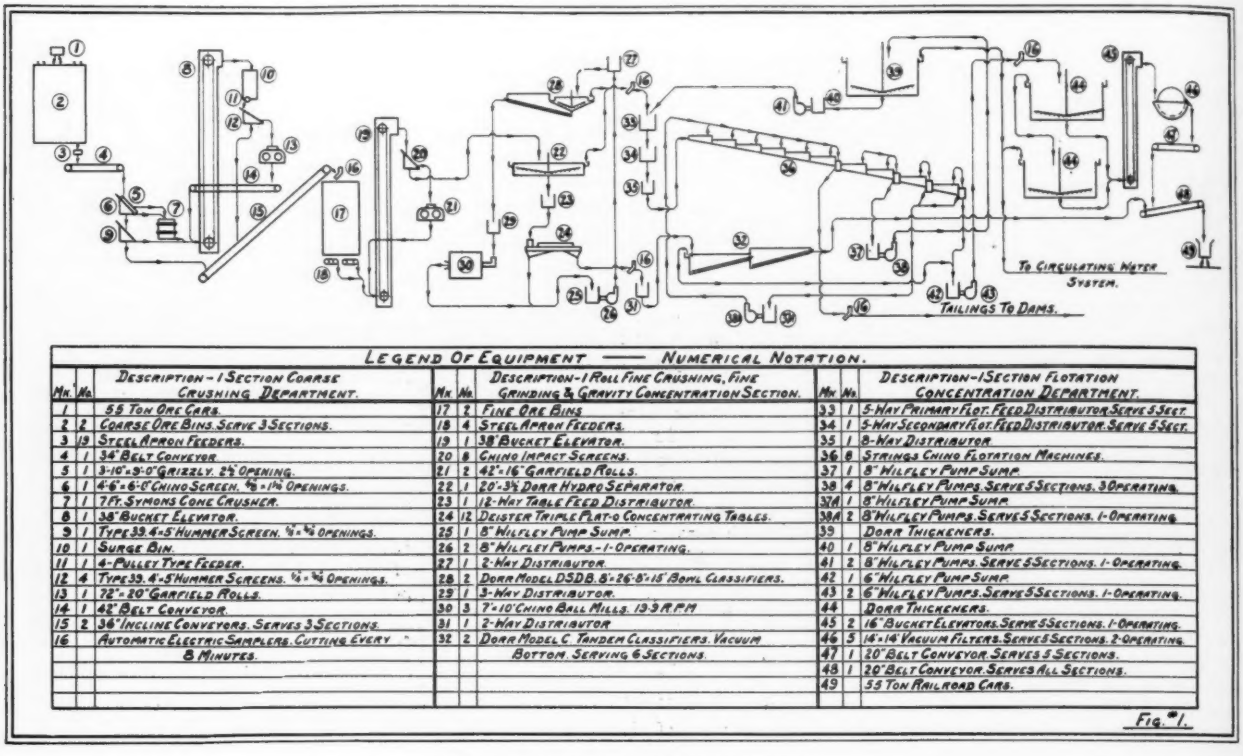
The screen undersize flows to one 20-ft. diameter by 3-ft., 6-in. deep Dorr hydro-separator. The overflow goes to a central flotation feed distributor and contains 29.6 percent of the original tonnage at 5.2 percent plus 100 mesh and 13 percent solids.

The hydro-separator underflow represents 70.4 percent of the total tonnage and contains 69.4 percent plus 100 mesh and 46.5 percent solids.

General view of the Hurley Plant of the Nevada Consolidated Copper Company, New Mexico Division, Chino Mines. Looking southwest.

* Paper presented before meeting of the New Mexico Chapter of The American Mining Congress, Santa Rita, N. Mex., July 25 and 26, 1927.

† Superintendent of Mills, Nevada Consolidated Copper Co., Chino Mines.



LEGEND OF EQUIPMENT —— NUMERICAL NOTATION.

Mk.	No.	Description—1 Section Coarse Crushing Department.
1		55 Ton Ore Cars.
2	2	Coarse Ore Bins. Serve 3 Sections.
3	19	Steel Apron Feeders.
4	1	34" Belt Conveyor.
5	1	3-10"×3'-0" Grizzly. 2½" Opening.
6	1	4'-6"×6'-0" Chino Screen. ⅝"×1¼" Openings.
7	1	7 Ft. Symons Cone Crusher.
8	1	36" Bucket Elevator.
9	1	Type 39 4-5 Hummer Screen. ⅜"×⅝" Openings.
10	1	Surge Bin.
11	1	4-Pulley Type Feeder.
12	4	Type 39 4-5 Hummer Screens. ¼"×⅝" Openings.
13	1	72"×20" Garfield Rolls.
14	1	42" Belt Conveyor.
15	2	36" Incline Conveyors. Serves 3 Sections.
16		Automatic Electric Samplers. Cutting Every 8 Minutes.

Mk.	No.	Description—1 Roll Fine Crushing, Fine Grinding & Gravity Concentration Section.
17	2	Fine Ore Bins.
18	4	Steel Apron Feeders.
19	1	38" Bucket Elevator.
20	8	Chino Impact Screens.
21	2	42"×16" Garfield Rolls.
22	1	20'-3½ Dorr Hydro Separator.
23	1	12-Way Table Feed Distributor.
24	12	Deister Triple Plat-O Concentrating Tables.
25	1	8" Wilfley Pump Sump.
26	2	8" Wilfley Pumps—1-Operating.
27	1	2-Way Distributor.
28	2	Dorr Model DSDB. 8'-26'-8"-15' Bowl Classifiers.
29	1	3-Way Distributor.
30	3	7'-10' Chino Ball Mills. 19.9 R.P.M.
31	1	2-Way Distributor.
32	2	Dorr Model C Tandem Classifiers. Vacuum Bottom. Serving 6 Sections.

Mk.	No.	Description—1 Section Flotation Concentration Department.
33	1	5-Way Primary Flot. Feed Distributor. Serve 5 Sect.
34	1	5-Way Secondary Flot. Feed Distributor. Serve 5 Sect.
35	1	8-Way Distributor.
36	8	Strings Chino Flotation Machines.
37	1	8" Wilfley Pump Sump.
38	4	8" Wilfley Pumps. Serve 5 Sections. 3 Operating.
38A	1	8" Wilfley Pump Sump.
38A	2	8" Wilfley Pumps. Serve 5 Sections. 1-Operating.
39		Dorr Thickeners.
40	1	8" Wilfley Pump Sump.
41	2	8" Wilfley Pumps. Serve 5 Sections. 1-Operating.
42	1	6" Wilfley Pump Sump.
43	2	6" Wilfley Pumps. Serve 5 Sections. 1-Operating.
44		Dorr Thickeners.
45	2	16" Bucket Elevators. Serve 5 Sections. 1-Operating.
46	5	14×14 Vacuum Filters. Serve 5 Sections. 2-Operating.
47	1	20" Belt Conveyor. Serves 5 Sections.
48	1	20" Belt Conveyor. Serves All Sections.
49		55 Ton Railroad Cars.

Fig. 1.

Figure 1. Flow Sheet—Hurley Plant

This product is distributed over 12 Deister triplex Plat-O concentrating tables operating at 260 r. p. m. with a 1-in. stroke. These tables are operated intermittently, depending upon whether or not the ore contains native copper.

The average tonnage of finished table concentrates, when the tables are in operation, amounts to 24.28 percent of the total concentrate production and represents 22.25 percent of the total copper production.

The table concentrate flows to two Dorr model "C" classifiers, in series, both equipped with vacuum bottoms, where it is dewatered to approximately 6 percent moisture and conveyed directly to railroad cars.

The Deister table tailings flow to two 8-in. Wilfley pumps, one only operating, and are elevated to two 15-ft. Dorr model DSD, duplex bowl classifiers, reciprocating rakes operating at 27 strokes per minute, bowl rakes operating at an average of 6 r. p. m.

The bowl classifier overflow amounts to 70.4 percent of the original tonnage and contains 14.4 percent plus 100 mesh and 19 percent solids. This product joins the overflow of the hydro-separator and flows to a central flotation feed distributor.

The rake product amounts to 2,859 tons per 24 hours and contains 91.8 percent plus 100 mesh and 75.4 percent solids, the ratio of circulating load to original feed being 2.49 to 1. This product is distributed to three 7 x 10-ft. ball mills, operating at 19.9 r. p. m. The discharge of the ball mills joins the Deister table tailings and flows to an 8-in. Wilfley pump, where it is returned to the classifiers, thus completing the closed circuit.

The flow sheet on the section equipped with one 8 x 12-ft. rod mill is as follows:

The ore is fed from the bottom of the fine ore bins by two apron feeders on to one conveyor feeding the rod mill. The rod mill product flows to one 6-in. Wilfley pump, where it is elevated to one 20-ft. x 3-ft. 6-in. Dorr hydro-separator, the balance of the flow sheet on this section being the same as the roll sections.

The flotation department consists of five sections, each section equipped with eight rows of locally designed pneumatic machines. Each cell is 15 ft. long over all, 30 in. wide and 24 in. deep at the shallow end, the bottom sloping at the rate of ½ in. per foot.

Each row consists of six rougher cells in series, two first cleaner cells in series, one second cleaner cell and one third cleaner cell which serve two rows of roughers and first cleaner cells.

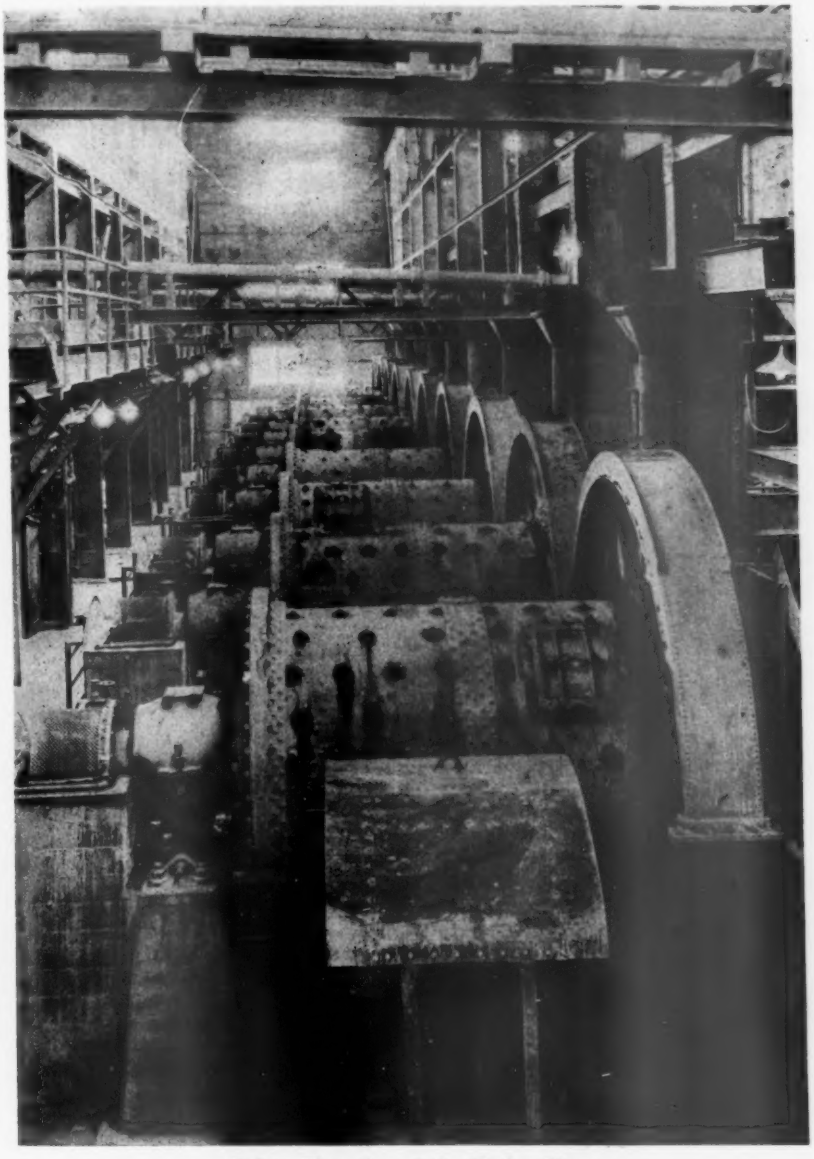
The primary and secondary bowl classifier overflow is piped to one central distributor, where it is equally divided to the five flotation sections. It is then equally distributed to each of the eight rows comprising one section by a sectional feed distributor located at the head of each section.

The rougher concentrates flow by gravity to the first cleaners, first cleaners by gravity to second cleaners and second cleaners by gravity to third cleaners, where the finished concentrate is made. The flotation concentrate from the entire mill is elevated by means of one 6-in. Wilfley pump to one 50 x 20-ft. Dorr thickener, where it is automatically sampled, thickened to approximately 70 percent solids and fed into the filter plant consisting of four 14 x 14-ft. Oliver type and one 14 x 14-ft. Shimmin interior type filters, of which not to exceed two filters operate. The filter cake is conveyed direct to railroad cars.

The overflow from the 50-ft. thickener flows to one 75-ft. thickener, the overflow of the 75-ft. thickener to the return water system and the underflow intermittently to the filters.

The tailings from the sixth rougher cells, after passing through automatic samplers at the plant, flow through pipe lines to the tailings dams.

Cleaner Tails: The tailings from the first cleaner cells are thickened in Dorr thickeners to approximately 20 percent solids and returned to the head of the roughers; the tailings from the second and third cleaner cells are returned to the head of the first cleaners. The overflow from the Dorr thickeners—that are thickening cleaner tailings—returns to the mill water system.



Tube mill section of the Hurley Plant

Tailings Disposal

Tailings are disposed of by means of gravity flow through two 20-in. continuous wooden stave pipe lines—one only operated—to tailings ponds, a total distance of 9,865 ft. (See Fig. No. 2.) The tailings flow containing 78.939 percent H_2O starts at elevation 5,615.4 ft. and the elevation at the ponds is 5,546.64 ft., or a static head of 68.76 ft.

The tailings are distributed around the ponds by 18 and 16-in. lines. The 18-in. line is level, and the 16-in. lines are installed on an average grade of .479 percent.

The average velocity in the 20-in. lines is 5.44 ft. per second, 18-in. lines 6.72 ft. per second and in the 16-in. lines 8.5 ft. per second.

At the present time for impounding tailings two ponds are used, known as Pond No. 3 and No. 4 (Fig. 2), the area of No. 3 being 42 acres with an exposed water surface of 5.6 acres, while Pond No. 4 has an area of 72 acres with an exposed water surface of 36.2 acres, making the total area used 114 acres.

The larger pond is used during the fall, winter and early spring when the evaporation is light and the smaller pond is used during the late spring and summer months when evaporation is at its highest.

When the larger pond is in service, the border is built up with a Martin ditcher and Fordson tractor to approximately 2 to 1 slope on the face.

Tailings are distributed around the outer edges of the pond by means of spigots located on the bottom of the line, spaced 10 ft. apart. The spigots are opened on one section of the dam at a time only; a 4 x 4-in. launder is placed at right angles to the pipe lines on every other spigot, the heavier portion of the tailings being deposited on the extreme edge of the border. The alternate spigots deposit directly under the line, so that a wide dike of tailings is built up. The crest of the dike is maintained about 2 ft. above the general level of the water in the dam. The water from the deposited tailings drains into the center of the pond, resulting in the heavier portion of the tailings being deposited on the dike clear of the trestle carrying the pipe line to permit building up of the border which is accomplished by a Martin ditcher and Fordson tractor.

The dike or border is built up in three sections, each section comprising approximately 800 ft., which composes a cycle. The spigots are drawn on one section, a

SCREEN ANALYSES

Opening & Mesh	Coarse Crusher Product:		Fine Crushing Product:		Secondary Bowl Classifier Feed		Gravity Concentrates		Flotation Feed		Gen'l Mill Tailing:		Gen'l Flot. Concentrate		Prim. Bowl Classf. Spigot		Discharge
	% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.	
On 1.050"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
.742	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
.525	7.8	7.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
.371	18.0	25.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4 Mesh	21.2	47.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	16.6	63.6	...	...	...	...	0.8	0.8	...	...	...	...	...	...	...	...	
14	2.8	66.4	3.0	3.0	0.4	0.4	1.4	2.2	...	...	...	...	...	...	6.2	6.2	
20	2.6	69.0	6.6	9.6	4.8	5.2	2.4	4.6	...	...	...	...	...	...	13.4	19.6	
28	2.8	71.8	8.6	18.2	6.0	11.2	4.2	8.8	...	...	...	...	...	...	12.6	32.2	
35	2.0	73.8	8.2	26.4	8.4	19.6	5.6	14.4	...	...	...	...	...	...	11.8	44.0	
48	3.2	77.0	6 8	33.2	12.0	31.6	9.2	23.6	0.6	0.6	...	...	...	...	9.6	53.6	
65	2.6	79.6	7.6	40.8	16.0	47.6	14.6	38.2	1.8	2.4	4.73	4.73	1.0	1.0	8.0	61.6	
100	1.8	81.4	9 6	50.4	22.0	69.6	28.4	66.6	10.2	12.6	12.67	17.40	4.0	5.0	7.8	69.4	
150	3.2	84.6	6.0	56.4	6.2	75.8	13.4	80.0	10.0	22.6	11.84	29.24	6.0	11.0	3.6	73.0	
200	3.8	88.4	9.6	66.0	6.4	82.2	13.0	93.0	4.8	27.4	11.27	40.51	18.0	29.0	0.6	73.6	
-200	11.6	...	34.0	...	17.8	...	7.0	...	72.6	...	18.98	59.49	71.0	...	26.4	...	

second section is drying and a third section under process of building up with the Martin ditcher and Fordson tractor. The time of the cycle depends upon weather conditions, one cycle usually requiring approximately 15 days.

An average of 6.55 percent of the water delivered to the pond, or 25.6 percent of the weight of tailings, is deposited with the tailings.

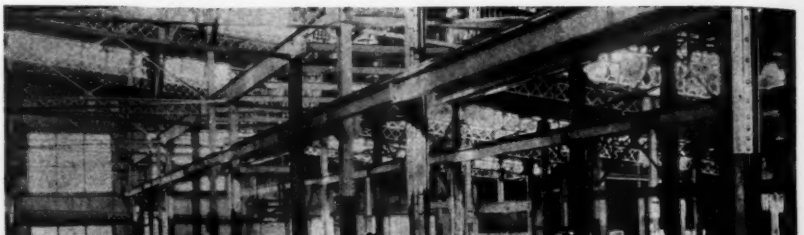
The average evaporation per acre exposed amounts to 6.57 g. p. m. A well is located in the pond that furnishes approximately 200 g. p. m. from an underflow not connected with the pond.

The water is accounted for as follows:

Return water	91.60%
Deposited with tails...	6.55
Evaporated	1.50
Seepage	.35

The clear recovered water averages 91.6 percent of the total and is skimmed from the center of the pond by means of dewaterers connected to a 36-in. tile line, reinforced with concrete, which is located in the natural ground under the deposited tailings. The dewaterers proper are built up with 4 x 6-in. timbers whenever necessary to maintain clear water.

The water recovered flows through the 36-in. tile line to a vertical shaft and is pumped out of the shaft into a canal with two 3,000 g. p. m. Worthington Axiflo pumps and one 2,000 g. p. m. Layne and Bowler pump. The canal discharges into an artificial lake located east of the mill where a permanent pump station is located. From this station the reclaimed tailings water, together with any flood water, is pumped to the mill reservoir, approximately 4,768 ft. horizontally from the station and under static head of 180 ft. This station has four two-stage Cameron centrifugal pumps, each having a capacity of 3,000 g. p. m. Normally, two pumps are operated at this station.



Flotation department of the Hurley Plant

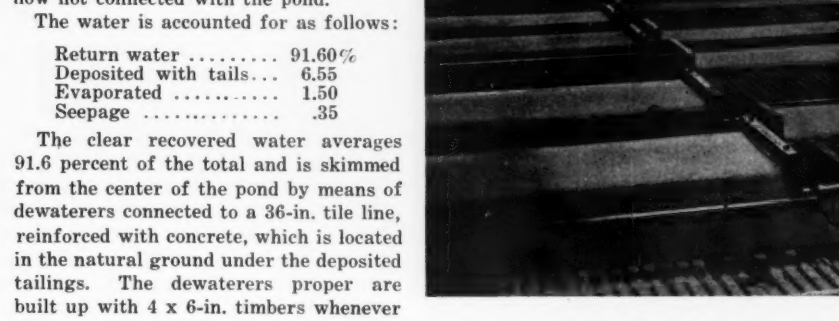


Figure 2. Reclaim water system at the Chino Mines of the Nevada Consolidated Copper Company

Initial Water Supply

Initial water is pumped to the townsite from four pumping plants, the main source of supply being pumped from the Apache Tejo Station, located 4 miles south of Hurley. At this station the water is air-lifted from three wells. One of the wells is cased to a depth of 160 ft. with 14-in. casing, the second is cased with 170 ft. of 14-in. casing and the third well is cased to a depth of 1,077 ft. with 12-in. casing. Two wells are equipped with outside pipe type 8-in. air-lifts, the foot pieces located 335 ft. below the delivery point. The third well is equipped with central air pipe type air-lift with 2½-in. pipe, the foot piece being located 350 ft. below the delivery point, all three served by three Ingersoll-Rand, type XB-2, 17 x 10 x 14 air compressors. All three wells deliver to a concrete sump from which two Aldrich quintuplex plunger pumps deliver to a 223,000-gallon initial water supply tank at Hurley. The water from this station, 1,273 g. p. m., comprises water for domestic purposes and power plant, the excess being used in milling operations.

The "B" Ranch Station is located one-half mile northeast of the concentrator. The supply of water at this station is secured by means of a tunnel driven on bedrock across Whitewater Creek, and flows by gravity to the suction of a 750 g. p. m. Aldrich triplex pump, from which it is pumped to the main mill reservoir under static head of 171 ft. It supplies 605 g. p. m.

Whiskey Creek Station is located five miles west of the concentrator, on Whiskey Creek. The water supply at this station is secured from drainage tunnels along the bed of Whiskey Creek, approximately 180 g. p. m. being secured from this station and pumped to Cameron Creek Station, where it is relayed to the reservoir (*Continued on page* 790)

Opening & Mesh		Prim. Bowl Classifier Overflow		Secondary Bowl Classifier Sands		Secondary Bowl Classifier O'flow		Ball Mill Discharge:	
		% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.	% Ind.	% Acc.
On	14	....	....	2.0	2.0	....	....	0.4	0.4
	20	....	....	7.6	9.6	....	....	2.8	3.2
	28	....	....	11.4	21.0	....	....	4.2	7.4
	35	....	....	15.2	36.2	....	....	10.0	17.4
	48	....	....	16.4	52.6	0.6	0.6	17.8	35.2
	65	1.0	1.0	21.8	74.4	2.2	2.8	21.8	57.0
	100	4.2	5.2	17.4	91.8	11.6	14.4	20.8	77.8
	150	8.8	14.0	4.0	95.8	13.0	27.4	5.2	83.0
	200	11.2	15.2	2.0	97.8	4.2	31.6	4.0	87.0
	-200	74.8	....	2.2	....	68.4	....	13.0	....

MINING METHODS AT THE CHINO COPPER MINES *

Open-Pit Methods Used In Mining Ore At Chino—Electric And Steam Shovels Used In Loading Ore And Waste—An Outline Of Methods Of Mining And Handling Ore And Stripping—Comparative Operating Costs

By H. A. THORNE †

IT is not the intention of this paper to go into detail more than is necessary to give an outline of the method of mining and handling of the ore and stripping, and to cover the points which would be the most prominent when visiting the property. Open pit mining only will be considered, as to date only some shaft sinking has been done as a start toward underground mining.

The preparation of the ground for pit mining is practically similar to the mining itself, consisting of opening benches of a height to warrant the most economical handling of material. The benches at present vary in height from 40 ft. to 100 ft., the higher benches being in stripping, where on account of the contour of the ground, it was found more economical to carry a higher bench rather than establish intermediate benches. The benches for future work have been planned for a height of 42 ft., which has been found to be the most practical height for the class of material as found on this property. It is also the best height for effective breaking and working with the present equipment. The width of benches varies, due to local conditions, but are always maintained of a sufficient width that the benches beneath may be worked without endangering loading tracks on the benches above. This requires a minimum width of approximately 50 ft. In establishing benches, it is sometimes necessary to do so by a series of what are called "drop cuts," in which the shovel is working at a lower depth than the track on which the material is being loaded. With the standard railroad type of shovel the maximum drop of each cut is 8½ ft. After establishing a bench the loading track is kept level with the shovel.

In breaking the ground for loading a combination of toe holes and churn drill holes are used in the hard ground, and churn drill holes only in the softer ground. Where the combination of both class of holes are used, the toe holes are shot first. The toe holes are drilled with both hammer and piston drills, the former are Denver Rock Drill Co.'s turbos and Waugh No. 17 and the latter are Sullivan 2¾ in. The piston drills are used in ground which is inclined to ravel badly during drilling, and are found to be more rapid and economical than the hammer drills for the depth of hole drilled, which is 22 ft. Toe holes are started with 2⅝-in. bits and bottomed with 1¾-in. The churn drill holes are drilled with Cyclone churn drills, models No. 12 and No. 14. These drills are self-propelling and are powered with gas engine. The holes drilled with the No. 12 drill are 4½ in. in diameter and with the No. 14 drill holes are 6 in. in diameter. The spacing of both toe and churn drill holes is determined by local conditions, though in the average bank a spacing of 15 ft. for the toe holes, and 20 ft. for the churn drill holes is adhered to as far as possible. It is, however, often advisable to deviate from the spacing, due to hard projecting points, or ground which can not be drilled easily. In general the spacing of holes is determined by the character of the ground and is under the direction of the foreman in charge. In all cases the practice is to have all holes bottom 5 ft. below the bench, in an effort to better break the bottom. All holes are sprung, or chambered, in order to have the major portion of the powder at the point of greatest resistance. Churn drill holes are stemmed with screened dirt, no stemming is used in the toe holes. All toe holes are fired with No. 8 electric blasting caps, two caps to a hole, one placed in the bottom of the hole and the second at a point where the powder begins to raise out of the chamber. The electrical connection is made in series and fired with a 50 cap blasting battery. Not more than 10 holes are fired at one time; this allows quite a factor of safety for the battery. The churn drill holes are detonated entirely with Cordeau, two lines of Cordeau being used in each hole; each line of Cordeau in a hole is taken from different spools, this precaution being taken in case one spool of Cordeau may be defective. Preparatory to blasting all Cordeau in the holes is connected to a common trunk line, and the latter detonated with No. 8 electric blasting caps, fired with a battery. There is no limit as to the number of churn drill holes that may be fired at one time. The usual practice is to shoot from 5 to 10 holes together.

The powders used are Apache gelatin 40 percent and 60 percent and Apache standard 40 percent and 60 percent which comes in 1¼-in. by 8-in. cartridges and Apache Quarry Nos. 1 and 4, both bag or bulk powders. A small amount of black powder is also used. The 40 percent stick and Quarry No. 4 are used in the soft ground, the 60 percent stick and Quarry No. 1 are used in the hard ground and the black powder is used only in very soft and greatly fractured ground. In all ground containing an excessive amount of water the gelatin powders are used. The average charge of powder for toe holes is 100 pounds, and

* Paper presented before meeting of New Mexico Chapter of The American Mining Congress, Santa Rita, N. Mex., July 25 and 26, 1927.

† Superintendent of Mines, Nevada Consolidated Copper Co., Chino Mines.

Chino Mines at Santa Rita, New Mexico

for churn drill holes 300 pounds. In most of the ground considerable secondary blasting is necessary, on account of large boulders. Whenever possible this secondary blasting is done with short holes, drilled with Waugh Jackhammers. At times dobeying, or mud capping, is resorted to when it is impractical to stop a shovel in order to drill the boulders. All block holes and dobies are shot with ordinary blasting fuse and No. 9 blasting caps.

Model 350 electric shovel, weight 450 tons, 8-cubic-yard dipper, 80-ft. boom, 54-ft. dipper sticks. Also a Bucyrus 30-B Diesel engine shovel, weight 45 tons, ¾ yard dipper

The loading is done wtih Marion electric and steam shovels. There are 13 Model 92 railroad type, of which three are electrically operated and 10 steam operated; one Model 100 steam shovel and one Model 350 electric. All shovels are equipped with 3½-cu. yd. dippers, with the exception of the model 350, which is equipped with an 8-cu. yd. dipper. Of the railroad type, six are mounted on standard railroad trucks and seven are mounted on caterpillar tractors. There is a decided advantage in the latter type of mounting, due principally to the rapidity with which the shovel can be advanced when loading, or can be moved to a new location on the same bench. A smaller pit crew is also used, as there is no track to maintain for the movement of the shovel. There is a saving of approximately 10 cents per cubic yard for the caterpillar type of mounting over the truck type. However, all shovels on the property are not mounted on caterpillars, as it is often necessary to move a shovel from one bench to another of different elevation. In such cases it is necessary to dismantle the caterpillars and place the shovel on railroad trucks to be moved. This dismantling and subsequent reassembling requires approximately 48 hours; therefore it has been deemed advisable to maintain a certain number of truck shovels, so that moves can be made with a minimum loss of time and expense.

The electric shovel is a development of recent years, and has proven a great deal more economical unit than the steam machines, both from an operating and maintenance standpoint. The power is brought to the synchronous motor generator set on the shovel at 4,000 a. c. and the output is supplied to the d. c. motors at 250 volts.

Comparative operating costs of steam and electric shovels of the same type, show a saving of $55 per shovel shift in favor of the electric.

The model 350 electric shovel, revolving type, is used principally in special work, in which a railroad type would be greatly handicapped, such as in making a "through" or box cut. This shovel is able to revolve and load cars behind itself, which the railroad type can not do. In making "drop cuts," the model 350 shovel can load cars on a track 42 ft. above its working level, thus accomplishing in one cut the work requiring five cuts by a standard railroad type shovel. During this year, the model 350 shovel has moved 2.52 times as much yardage as the average for the electric and steam powered railroad type of shovels, at the same cost per shovel shift.

The ore and stripping moved by the power shovels is loaded into automatic ore dump cars, equipped with automatic air brakes and other standard equipment, of the following types and capacities:

35 Clark cars, 30 cu. yd. capacity, drop door type.
15 Clark cars, 20 cu. yd. capacity, drop door type.
40 Company re-built cars, 20 cu. yd. capacity, raised door type.
14 Oliver cars, 12 cu. yd. capacity, raised door type.

There are required for train service, a total of 21 steam locomotives of the following type:

10 American 6-wheel saddle tank locomotives, cylinder 21 x 26 in.
7 Porter 4-wheel saddle tank locomotives, cylinder 16 x 24 in.
4 Porter 4-wheel saddle tank locomotives, cylinder 15 x 24 in.

Two of the smaller type locomotives are used as extras for the train service and two are used for general switching service on the industrial tracks. The American locomotives handle from 120 to 150 cu. yds. of material, depending upon grades, while the average load for the 16 x 24-in. locomotive is 80 cu. yds., the smallest machines handling only 60 cu. yds.

All material loaded has one of three destinations: direct to mill; to the coarse crushing plants; to the dumps. The ore loaded direct to the mill consists of material which is fine enough to pass through a 10-in. grizzly without crushing. This ore is loaded at the shovel into cars belonging to the Atchison, Topeka and Santa Fe Railroad Co. and is transported to the assembly yards below the coarse crushing plants. Coarse ore is transported to the crushing plants, one of which is equipped with a 48-in. by 60-in. jaw crusher of the Blake type, the other being equipped with one 66-in. by 84-in. of the same type. The ore is dumped over grizzlies with 8-in. spacing, the coarse ores only going to the crushers. The crushed ore, together with the undersize from the grizzlies is conveyed to steel loading bins, from where it is loaded into Santa Fe ore cars for transporting to the mill. The other material, consisting of stripping and very low grade ore, is hauled to the dumps.

The amount of trackage in service from the points of loading to the point of delivery, varies from month to month, but will average 26 miles, as follows:

Main lines	10 miles
Bench lines	12 miles
Dump lines	4 miles

All tracks are of standard gauge, laid with 75 pound rails. Cross ties are 7 x 9-in.-8-ft. Oregon fir, spaced 20-in. centers. On account of heavy traffic, all frogs are of the solid manganese type. Manganese steel switch points were also tried, but did not prove satisfactory. The grade of all track varies considerably, the maximum gradient being 2½ percent. For the maintenance of tracks and dumps, two Nordberg track shifters and one Jordan spreader are in service. In moving track, it is estimated that one track shifter with an operator and helper, replaces 20 track men. The Jordan spreader is used to level off the dumps, as well as the spill in the pits, preparatory to shifting the tracks.

MINING METHODS OF THE HANOVER BESSEMER COMPANY *

Underground Glory Hole System Used—Deposits Of Magnetic Iron Ore—Mining Methods Must Be Inexpensive, Since Ores Are Hauled 694 Miles To Pueblo—Methods Of Sampling, Drilling, Timbering, Haulage And Ore Preparation Outlined

Ore bins, crushing plant, power house and mill of the Hanover Bessemer Iron and Copper Company, Fierro, New Mexico

By L. M. KNIFFIN †

INTRODUCTION

IT is unusual that a prominent mining community like Santa Rita should have lesser mines surrounding it that produce so many other kinds of ores. With blast furnaces and other treatment plants the district could almost operate independently of the rest of the country. The mines at Fierro now supply the hard ore requirements of the Colorado Fuel and Iron Co. and shipments are made at the rate of about 800 tons per day.

GEOLOGICAL FEATURES

The Fierro district presents one of the best-known examples of contact ore deposition. An intrusive mass of granodiorite about two and one-half miles long from north to south and one mile wide is surrounded by sedimentaries. The iron ore is essentially magnetite and forms replacement bodies in limestone abutting the igneous mass. The bodies almost surround the igneous mass and are limited to the distance that the metamorphosing and mineralizing influence extended. The silicate development in the limestone extends over about the same area.

CHARACTER OF ORE

The magnetite ore normally contains about one percent copper as the magnetic sulphide Chalmersite $CuFe_2S_3$. Usually the Chalmersite is fine grained, but some attractive specimens are found in which the golden copper mineral stands out on a background of black magnetite.

The action of meteoric waters has leached the small quantities of copper from the fractured bodies of iron and redeposited in concentrated form as carbonates, oxide and sulphide, forming pockets and seams usually close to the granodiorite.

ZONAL ARRANGEMENT

The district presents an interesting zonal arrangement of a great variety of valuable ores. The redeposited copper ore which occurs close to the igneous mass is surrounded by the band of iron ore. Next in order comes a zinc ore zone. A variety of sphalerite high in iron has been deposited in favorable fractures in the limestone as a fringe around the iron. In places the sphalerite has been deposited with the magnetite in the iron ore zone and the magnetite is found in the masses of zinc ore, but in general each class of ore is limited to its own zone.

On the side of the igneous mass the zinc ores are remarkably lead free, but at greater distances galena comes in and the outside zone contains both lead and zinc. Surrounding this zone there is another zone of lead-silver and silver ores.

We do not know that the coarse grained Fierro granodiorite is part of the parent magma, but it seems more than a coincidence that so many workable deposits of these ores occur at about the same distances from a core.

STRATIGRAPHIC ARRANGEMENT

This main mass of granodiorite was forced upward through about 2,000 ft. of limestone and shale, elevating and fracturing these rocks so that erosion removed them and cut a valley out of the underlying igneous mass. The same movement bent up the edges of the rocks around the periphery so that today, except for local irregularities, they dip outward and away on all sides from the granodiorite at angles averaging about 50 degrees. The section, Figure I, will make the relations more clear.

At Fierro the ore is found in the "Fusselman" limestone and will probably extend into the "Montoya" and El Paso limestone. These lie below the Percha shale, which is thinner at Fierro than at most other exposures in the vicinity. Most of the other ore bodies that are being worked in the district are located in the Fierro limestone above the Percha shale.

CONTACT METAMORPHISM

The granodiorite body is remarkable in the manner in which it has altered

*Paper presented before meeting of the New Mexico Chapter of the American Mining Congress, Santa Rita, N. M., July 25 and 26, 1927.

† Manager, Hanover Bessemer Iron and Copper Co., Fierro, New Mexico.

and mineralized the abutting limestone. This alteration has reached out for distances up to 1,500 ft., but usually constitutes a zone 25 to 100 ft. wide. Where the original lime was pure it has been extensively marbleized, and this condition is an indication of high-grade iron ore bodies. In other places silica has apparently been introduced, the ore is of lower iron content, and ferro-magnesium silicate minerals are present.

A section across the contact usually starts with a layer of green mica schist and a band of iron silicate minerals against the granodiorite footwall. In some places, however, there is a wide zone of massive garnet rock taking the place of the silicates.

Toward the center of the contact zone the silicates usually decrease and serpentine and magnetite gradually increase. The ore zone contains but little else than magnetite and varies from 5 to 200 ft. in width. In some cases this zone is split up by silicate bodies, and mining problems are then introduced.

Toward the outer margin the iron usually becomes more pure and the generalization is justified that the best magnetite ores occur next to the marbleized lime hanging wall. The contact is in most cases steeper than the bedding, however, and replacement differs in different beds.

Ore Bodies

The ore bodies that are workable at present are the high-grade cores of the mineralized area. They are extremely irregular in size and shape, but run more or less parallel to the contact and are usually lenticular in shape. They sometimes contain horses of serpentine and other silicate minerals which also are irregular in shape. The ore bodies, on the whole, are vein like in form and sometimes extend for long distances on strike.

Mining Method

The method that has been developed for working these irregular deposits is best described as an underground glory hole system. It is an adaptation of the method that was originally used for working the large bodies that outcropped at the surface.

The requirements of the system are, first: that it be inexpensive to operate. The ores are hauled 694 miles to Pueblo, Colo., and can not stand a very large mining cost.

In the second place, the system used must provide for the removal of the parts of the contact zone that are too low grade to ship. This condition precludes the general use of a shrinkage stope method, although it has been used in some bodies of exceptionally uniform grade.

A third requirement is that the iron content of the shipments be maintained.

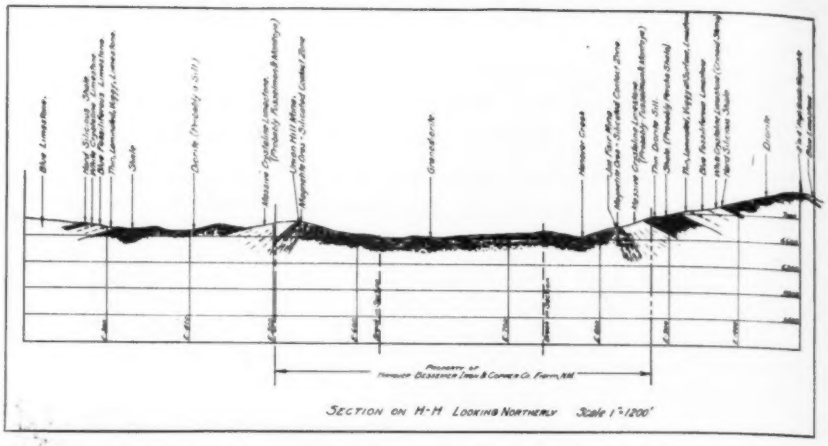


Figure 1. Vertical cross section of Fierro district, showing the contact ore bodies and the geological structure

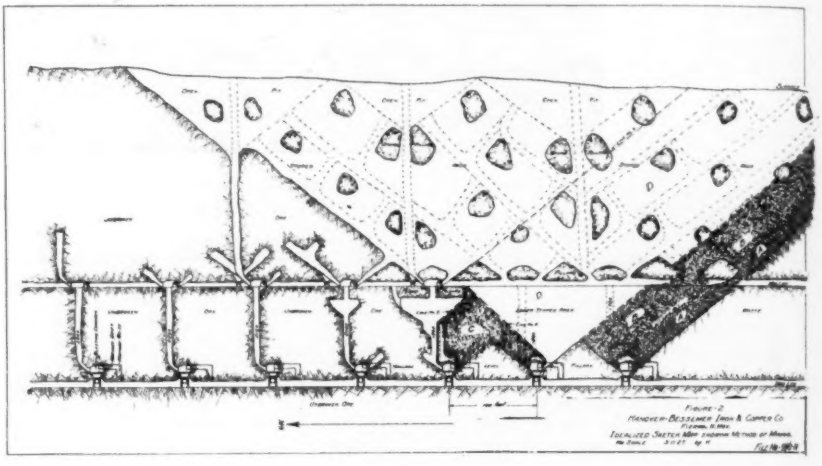


Figure 2. Idealized sketch map showing method of mining. Hanover Bessemer Iron and Copper Company

It is necessary to follow the ore and carefully avoid breaking any material that is below the profitable grade of 45 percent Fe.

Fourth, the hardness of the ore and its massive nature require that a system be used that will provide for breaking up the large boulders to a size that can be handled in chutes and not cause excessive wear on the cars.

In some parts of the deposit the hanging wall is composed of silicates, difficult to support, and a fifth requirement is that the system must provide for pillars at irregular intervals for supporting the wall.

The system in use fulfills all of these conditions in a satisfactory manner. This will be clearer by reference to Figure 2, which is an idealized section parallel to the trend of the ore zone. This section is inclined at about 50 degrees from the horizontal and runs along the dip.

Opening the Ore Body

The lower working is an adit level and the ore cars discharge to the bins at the crushing plant at the surface. This adit is about 350 ft. below the outcrop of the ore bodies, and to facilitate driving the raises a narrow intermediate drift is driven 125 ft. above the main haulage level. Small cars and 18-in. gauge track are used on the intermediate level, whereas 5-ton cars and 36-in. gauge track are used on the haulage level.

As the raises are put up at an inclination of about 50 degrees, we find it advantageous to drive them large size, about 8 by 14 ft. We have no difficulty with raises of this size stopping up and the large quantity of ore is mined at a cost per ton not much greater than stoping cost.

The intermediate level is not continuous. It is stopped when the ore body pinches out or is interrupted by the intrusion of igneous masses. For this reason the first raise in a series is a timbered raise with two compartments, one for a manway and the other as an ore

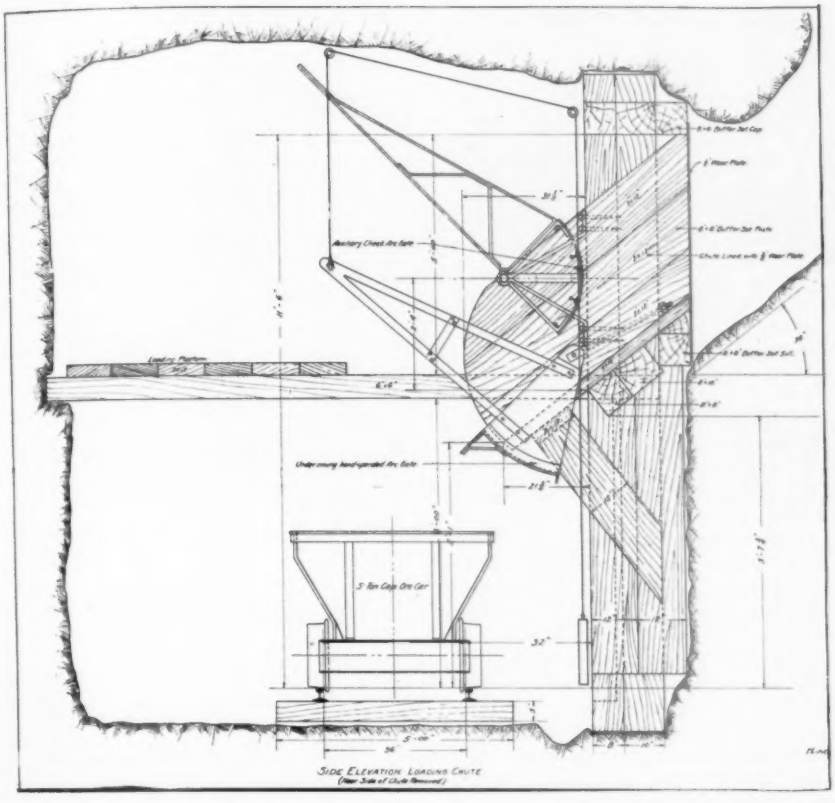


Figure 3. Detail of loading chute, Hanover Bessemer Iron and Copper Company

pass. The intermediate level is then started from this pilot raise. Succeeding raises are put through without timbering and obtain a fresh start from the intermediate level.

Blasting Chamber

As soon as a raise is completed, a blasting chamber is cut 26 ft. above the haulage level, as shown on Figure 2. This is provided with grizzly bars spaced 10 in. in the clear. A bulkhead of timbers is placed in the raise over the blasting chamber and a by-pass raise driven around it. This provides a place for taking up the shock of the falling ore and allows it to roll down a gentle slope to the grizzly.

A manway is provided for each chute. This is a vertical raise about 4 x 4 ft. and located on the main haulage way 25 ft. from the center of the chute. The drift connecting the manway and blasting chamber is driven with a 45-degree turn so that the flying rock will not fall down the manway. Light Jackhammer drills are used for drilling holes 1-in. in diameter in the boulders and ⅞-in. 35 percent dynamite is used for blasting. At one time inclined grizzlies were used, but we had numerous accidents and these were replaced by horizontal ones.

The standard chute arrangement is shown on Figure 3. By using both undercut and overcut gates it is possible to fill the cars and still avoid spilling on the haulage way. Since this arrangement was introduced, chute accidents have been almost eliminated.

The system was developed from the one used at the Alaska Gastineau mine and the Fresnillo unit of the Mexican Corporation.*

After the blasting chamber and chute are completed, stoping is started by drilling down holes and the ore slides down the raise. Pillars are left as required and only the ore of profitable grade is followed. When horses are encountered, the ore is cleaned down in the stope and the poor material is drawn separately and hauled to the waste dump.

A floor pillar 20 ft. thick is left below the intermediate level. The ore is so hard that these floor pillars stand in some cases for a width of 150 ft. A similar system will be used below the main haulage level, but the interval to the next lower level will be increased to 200 ft. so as to give a larger stoping height.

Waste Disposal

This system of mining allows for the disposal of waste, as will be seen by reference to Figure 2. The first chute at the right hand is closed by placing a bulkhead in the raise. Waste is then run in to fill area A. The ore exposed by this stripping is then blasted into the stope and drawn out through the next succeeding chute. Area B is then filled with waste and the process repeated.

Sampling

On account of the variable nature of the ore body, it is necessary to sample every working stope each shift. The results are posted on a chart and also at the entrance to each stope. The iron content of the ore can not be determined close enough by inspection and the work is directed from the daily analyses.

We derive much valuable information from long Jackhammer holes that are drilled from points in the stopes where information is desired. No couplings are used and where there is sufficient room to handle the steels, holes up to 22 ft. deep are drilled. The drillings are sampled and analyzed. Before a stope is exhausted such holes are drilled into all the walls and the information placed on the stope maps. Many parallel deposits of shipping ore are found in this manner.

These long holes are also useful in directing development headings. By keeping a long hole ahead, the direction can be laid out and smooth track curves made.

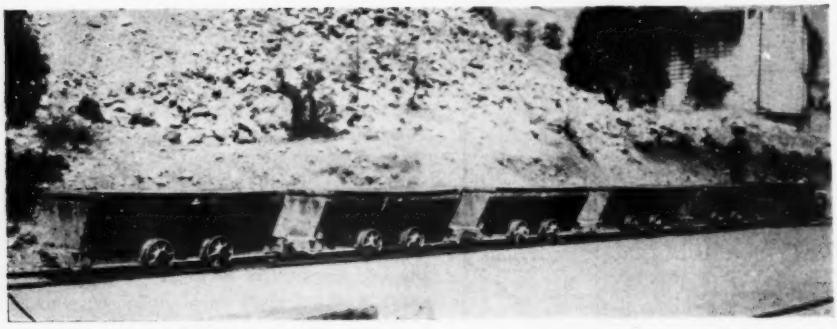
Where longer holes are desired we drill up to 100 ft. with sectional drill steel and turbo drills. We find that this work costs about as much per foot as diamond drilling, but the preparation where only a few holes are desired is less. When a considerable number of longer holes is desired, a diamond drilling campaign is undertaken. The cores from this work are much more reliable than the drillings from long holes with sectional steel.

Drilling

We used a contract system for some time, paying the drill operator per foot of hole drilled. After considerable experience we found that better results were obtained by paying the men a daily rate. Records are kept and we find that, although the feet drilled per shift is less the tons per man shift is greater under the day's pay system. The iron content of the ore broken is greater when the incentive for the miner is not only a great drilling footage. The average tons mined per shift employed underground is 9.165.

On account of the hard nature of the ore the cost of machine drill maintenance is high. Waugh line oilers are used on all air-operated machines. A special man is used to fill these oilers each shift.

* E. & M. J., Vol. 116, page 931.



Ore train at the Hanover Bessemer Iron and Copper Company

The average cost per ton of ore mined for all classes of drills is:

Repair labor	$.002
Replacements	.0012
Lubricants	.002
New drill steel	.011
Sharpening drill steel	.019
	$0.046

Some of the ore in the stopes is too hard for Jackhammer drills, and Leyner machines are required.

Ventilation

The system of mining affords very good natural ventilation. In driving long development headings it is sometimes necessary to use forced ventilation. For this purpose motor-driven blowers and flexible cloth pipe are used. In some cases headings 1,000 ft. long are ventilated in this manner, by air furnished by a single one-stage blower.

Timbering

This work has been standardized so that the framing can be done in the shop. The principal use for timber is for drift sets, loading chutes, pilot raises and ties. New Mexico Douglas fir (red spruce) is used for all purposes. On account of the slow rate of growth, the fiber is very compact and the timber is stronger and lasts longer than Oregon fir. The timbers are dipped in a creosote product (Carbolineum), which does not require heating except in very cold weather.

Explosives

Ray special dynamite, made by the Apache Powder Co., is mainly used in the stopes; 5.6 tons are broken per pound of this explosive. Gelatine dynamite is used for development work and in the blockholing chambers. The cost for explosives in stoping is $0.080 per ton and for blockholing $0.032.

The average drilling costs per machine shift are as below:

	Replacements	Repair Labor	Lubricants	Labor
B. C. R. 430 Jackhammers	$0.2510	$.0313	$.0605	$.3428
C. C. 11 Stoper	0.1582	.1128	.0610	.3320
S. 80 and 248 Leyner	1.1600	.2314	.0630	1.4544

Haulage

Griffith type bottom dumping cars are used for hauling ore. These cars were developed for coal mine haulage, but as now constructed they give good results in handling heavy magnetite ore. Each car holds five tons and the low position of the center of gravity gives minimum derailment troubles. Little time is lost dumping.

General Electric 2½ ton locomotives are used, equipped with 90 A 7 Edison storage battery cells. These batteries require careful supervision, but give good service. The original batteries proved to be somewhat too small, but gave five years life. The present batteries have larger capacity and we expect a longer life. The cost of handling ore per ton mile with this equipment is 10.227 cents. This includes loading and unloading.

Swivel type cars are used for hauling waste. These cars hold two tons and can be dumped from sides or end.

Ore Preparation

The ore is crushed in a gyratory crusher and passes over a picking belt, where low-grade material is excluded. The ore is then separated in plus and minus 2½-in. sizes. The fine ore goes to the blast furnaces and the coarse ore is used on open hearth furnaces.

The ore shipped is classified as Bessemer grade, although it is not now being used in Bessemer furnaces. An average analysis is:

	Percent
Iron	51.90
Phosphorus	.055
Silicon	6.54
Manganese	.54
Alumina	1.12
Lime	1.72
Magnesia	11.24
Copper	.57
Sulphur	.29
Loss	2.50

On account of its hardness, this ore is desirable for blast furnace work, as it keeps the blast furnace charge open. The excess of magnesia over silicon makes it desirable smelting material.

PRODUCTION OF NATURAL ABRASIVES IN 1926

The total quantity of natural abrasives sold by producers in the United States in 1926 was about 225,000 short tons, valued at over $4,500,000, according to a statement compiled by the Bureau of Mines, from individual reports furnished by producers. In addition, there were manufactured and sold during the year 73,603 short tons of artificial abrasives, valued at $6,751,165, divided as follows: Carbides, 17,026 short tons, valued at $1,702,037; aluminum oxides, 43,967 short tons, valued at $4,106,699, and metallic abrasives, 12,610 short tons, valued at $942,429.

NATURAL ABRASIVES SOLD BY PRODUCERS IN THE UNITED STATES, 1926

	Short tons	Value
Diatomaceous earth	87,126	$1,081,564
Emery	386	3,641
Garnet	6,397	523,875
Grinding pebbles and tube-mill lining	6,219	85,146
Grindstones	28,669	875,240
Millstones, chasers and dragstones	*	45,937
Oilstones, whetstones, hones, scythestones, and rubbing stones	1,640	218,359
Pulpstones	9,670	997,994
Pumice	53,887	208,504
Tripoli	31,369	523,609

* Quantity not reported by weight.

FLUORSPAR TARIFF

The Tariff Commission will shortly take up for action pending applications for an increase in the duty on imported fluorspar. Hearing on this case was given by the commission July 22. After final briefs are filed, October 1, by the interested parties, the commission will take up the case for decision which is likely to be rendered several weeks thereafter. Fluospar producers in Illinois and Kentucky will file a brief in support of an increased duty on the product on the ground that imported fluorspar can be sold under the present duty in the United States as far west as Pittsburgh for less than the American product. Steel interests east of Pittsburgh, who opposed the increased duty at the recent hearing are expected to file a brief in support of their contention that an added duty would burden eastern steel interests. A brief is also expected from German producers opposing an additional duty.

The Bureau of the Mint announces final estimates of refinery production of gold and silver in the United States during 1926 as follows: Gold, 2,335,042 ounces, valued at $48,269,600; silver, 62,718,746 ounces, valued at $39,136,497, against the production of 1925 last year showed a reduction of $1,590,000 in gold and 3,436,678 ounces in silver.

Teams of the Penelec Coal Corporation, winner of first place in the Mine Rescue Contest, and the Anaconda Copper Mining Co., winner of the First Aid Contest

INTERNATIONAL FIRST AID AND MINE RESCUE CONTEST

Over Two Hundred Thousand Men Trained To Date—Twenty-Three Separate Prize Groups Awarded—Forty-Nine First Aid And Nineteen Mine Rescue Teams Participate—Rock Dusting And Dust Explosions Demonstrated

THE sixth international mine rescue meet was held at Pittsburgh, Pa., August 30, 31 and September 1. There were present over 800 delegates and team participants, Bureau of Mines officials and mine inspectors.

Forty-nine first-aid and 19 mine rescue teams, representing coal and metal mines, quarries and oil producing operations, from 13 states, entered the contests, notable among whom was one of the teams from the Phelps Dodge Corporation of Arizona, which was composed of Mexican miners, who carried out their part with significant skill.

The first aid contest was conducted in the stadium of the University of Pittsburgh. The mine rescue contest was staged on the field at Carnegie Institute of Technology, with music by the Veterans of Foreign Wars Band.

The second day of the meet a special train over the Baltimore and Ohio R. R. conducted the visitors and guests to the bureau's experimental mine at Bruceton, Pa., where rock dust barriers and coal dust explosions were demonstrated, and various branches of mining research described. A live coal fire with an infected gas flame was smothered by stone dust to illustrate the proper method of application in fighting a mine fire.

Throughout the three day session, all in attendance were the guests of the Chamber of Commerce of Pittsburgh, in association with the local Red Cross and safety organizations, the University of Pittsburgh, and the Carnegie Institute of Technology.

The awarding of prizes took place at the conclusion of a banquet on Thursday evening at Syria Mosque, at which the toastmaster was Hon. John Ira Thomas, deputy secretary of the bituminous section, Pennsylvania Department of Mines.

After the invocation by Rev. Murdock McLeod, President Gaylor, of the Pittsburgh Chamber of Commerce, made an address of welcome and Mr. O. P. Hood, acting director of the United States Bureau of Mines, presented a message from Hon. Scott Turner, director of the bureau, who by appointment of the President, was attending the International Mining Congress in Canada.

Mr. Hood then delivered a forceful address on "The Government and Mine Safety" in the course of which he very clearly outlined the fact that the bureau does not have and does not wish to have any executive functions over actual mining, but does seek to cooperate and advise with all branches of the mining industry in any and all lines of endeavor for increased safety and efficiency.

Mr. John A. Oartel, president of the Western Pennsylvania Safety Council, spoke on "Safety Plus," and showed conclusively that the "Safety First" movement has resulted in increased production and improved quality of product.

Dr. R. R. Sayers, chief of the Health and Safety Branch of the bureau then took charge, and assisted by Dr. M. J. Shields, field director of the American Red Cross, and Mr. C. B. Auel, president of the National Safety Council, delivered the awards, as follows:

Teams of the Penelec Coal Corp., Seward, Pa., P. A. Frear, captain, and the Anaconda Copper Mining Co., Butte, Mont., C. O. Connell, captain, won highest honors in mine rescue and first-aid contests, respectively.

First-aid Contest—First honors, team representing Anaconda Copper Mining Co.; second, Phelps Dodge Corp., Morenci, Ariz.; third, Standard Oil Co., of Louisiana, Baton Rouge.

Mine Rescue Contest—First honors, Penelec Coal Corp.; second, Frick Coke Co., Mt. Pleasant, Pa.; third, Phelps Dodge Corp., Bisbee, Ariz.

Combined First-aid and Mine Rescue Contests—First honors, Penelec Coal Corp.; second, Phelps Dodge Corp., Bisbee; third, Pittsburgh Coal Co., Gallatin, Pa.

State Championships (First-aid)—West Virginia, Windsor Power House Coal Co.; Utah, Utah Copper Co.; Pennsylvania, Pittsburgh Coal Co., Gallatin; Montana, Anaconda Copper Mining Co.; Louisiana, Standard Oil Co.; Maryland, Union Mining Co., Mt. Savage; Virginia, Stonega Coal & Coke Co., Big Stone Gap; Kentucky, Hatfield Reliance Coal Co., Glenmawr; Indiana, Holmes Safety Assn., Chapter 25 Clinton; Illinois, Madison Coal Corp., Dewmaine; Arizona, Phelps Dodge Corp., Morenci; Colorado, Colo. Fuel & Iron Co., Tioga; California, Shell Co., Long Beach.

State Championships (Mine Rescue)—West Virginia, New River Coal Co., McDonald; Arizona, Phelps Dodge Corp., Bisbee; Pennsylvania, Penelec Coal

Corp., Seward; Illinois, Madison Coal Corp., Dewmaine; Maryland, Maryland Bureau of Mines, Kitzmiller; Virginia, Clinchfield Coal Corp., Wilder.

An onlooker at the entire convention could not fail to be impressed with the seriousness with which all the teams carried on their work. With the discipline of well-trained soldiers, every participant, upon hearing the problem announced, fell instantly into his place and without the slightest hesitancy or lost motion, performed his part.

When one realizes that over 200,000 men have received this training, and that this total is increasing at the rate of 2,700 men per month, all over the United States, the incomparable value of the work initiated by the late Dr. Joseph A. Holmes, first director of the Bureau of Mines, may be getter appreciated.

THE HURLEY MILL

(*Continued from page* 782)

The source of water at Cameron Creek is surface flow and amounts to 325 g. p. m.

Cameron and Whiskey Creeks together furnish 505 g. p. m. Both of these stations are equipped with Aldrich triplex pumps, each 750 g. p. m. capacity. The Cameron Creek Station is located three miles west of the concentrator and delivers to the mill reservoir under static head of 146 ft.

The average initial water for milling amounts to .1037 g. p. m. per ton of daily capacity.

Water recovered from the tailings dams and a well located in the pond amounts to .5667 g. p. m. per ton of daily capacity, thus bringing the initial and recovered mill water up to .6704 g. p. m. per ton of daily capacity.

Circulated water in the concentrator proper amounts to .5065 g. p. m. per ton of daily capacity, making the total water requirements 1.1788 g. p. m. per ton of daily capacity, or a ratio by weight of water to ore of 7.09 tons to 1.

Power Plant

The power plant is a steam plant, located at the mill, and is equipped with:

14—450 h.p. Heine water tube boilers, equipped with Heine superheaters, Tracy purifiers and Greene chain grate stokers.
4—B. F. Sturtevant economizers.

The boilers are operated under .7-in. induced draft furnished by two 16-ft. Sturtevant fans. Steam is generated at 175 pounds pressure, 50 degrees superheat.

All coal is furnished by the Gallup-American Coal Co., located at Gamerco, N. Mex., and is received from the mines in bottom dump cars and delivered to bunkers located over the boilers and fed on to Greene chain grate stokers by gravity. The average analysis of the coal is as follows:

B. T. U.	12,114
V. C. M.	35.1%
F. C.	46.2%
Ash	10.5%

The feed water is supplied to the boilers by three plunger pumps and one turbine driven centrifugal boiler feed pump. All auxiliary exhaust steam is delivered into four open boiler feed water heaters. The average temperature of the water leaving the heaters is 175 degrees F. and leaving the economizers the feed water temperature averages 250 degrees F.

In the power generating department there is one 6,000 k. w. Allis-Chalmers, steam-driven turbo-generator unit, operating continuously at 1,800 r. p. m., served by one Worthington No. 12 low-level jet condenser.

One Allis-Chalmers 2,000 k. w. turbo-generator operating continuously at 3,600 r. p. m., and served by one Worthington No. 5 low-level jet condenser.

Three Nordberg cross-compound Corliss engines, 27 x 60 x 48-in., operated at 100 r. p. m., direct-connected to three Allis-Chalmers alternators of 1,250 k. w. capacity each, one only Nordberg unit operating continuously. Each engine is served by one 4,000-sq. ft. Worthington surface condenser.

All power is generated at 480 volts and is stepped up to 24,000 volts for transmission to Santa Rita and Pump Stations located near Hurley. The power for the mill circuits is transmitted direct at 480 volts at the busses.

All power plant circulating water is cooled in three 5,500 g. p. m. Nordberg stack cooling towers and one Power Plant Equipment Co.'s 12,000 g. p. m. spray pond.

Power Consumption Per Ton Ore Milled

Departments:	K. W. H.
Coarse crushing	1.4592
Fine crushing	3.0187
Fine grinding	6.5959
Gravity concentration	.3812
Flotation	4.4195
Concentrate dewatering	.5373
Miscellaneous	.0372
Total direct milling	16.4490
Water service	3.6333
Shops, foundry and compressors	.1433
Grand total	20.2256

MEMORIAL TO JUDGE GARY

According to recent reports, plans are being made at Gary, Ind., for the erection of a permanent memorial to the late Judge Elbert H. Gary, chairman of the United States Steel Corporation, who was largely responsible for the laying out and upbuilding of the city of Gary.

INCREASED PRODUCTION OF SHEET MICA IN 1926

The total quantity of uncut mica sold by producers in the United States in 1926, as reported by the United States Bureau of Mines, was 8,129 short tons, valued at $536,827. Of this quantity 1,086 tons (2,172,159 pounds), valued at $400,184 was sheet mica; the rest was scrap mica.

The production was made by nine states, North Carolina, New Hampshire, New Mexico, South Dakota, Virginia, Georgia, Colorado, South Carolina, and Connecticut, named in order of total quantity from greatest to least.

The total sales of uncut sheet mica in 1926 showed an increase of 21 percent in quantity and 24 percent in value, as compared with 1925. The total scrap mica sold showed a decrease of 27 percent in quantity and 21 percent in value, as compared with 1925.

The average value per pound of all sheet mica sold in the United States in 1926 was about 18 cents, the same as in 1925, and the average value of scrap mica a short ton was about $19 in 1926, as compared with $18 a ton in 1925.

The imports of mica for consumption were 6,318,096 pounds, valued at $2,450,834. Corresponding figures for 1925 were 4,901,308 pounds, valued at $1,798,827.

FELDSPAR REPORT

Two new microscopic methods for the quantitative analysis of feldspar which seem suitable for commercial plant control work have been developed by the Bureau of Standards. The new methods involve quantitative analyzation of the optical properties, contrasted with the usual chemical property analysis. The bureau says that the methods are of interest because it is important to know the composition of the feldspar used in order that the properties of the finished product may be more easily controlled.

Clarence M. Charest succeeds A. W. Gregg as general counsel for the Internal Revenue Bureau on October 1. Mr. Charest, who was born in California 43 years ago, has been in the bureau since 1921, having served as special attorney in the former solicitor's office, chief of the interpretive and appeals divisions and assistant to the general counsel. He attended law schools at Michigan and Maryland universities, graduating from the latter in 1906. Before entering the bureau he was assistant counsel of the Maryland Casualty Company of Baltimore. Mr. Gregg will engage in private business in New York.

NEWS OF THE MINING FIELD

A Resume Of The Activities Of The Mining Industry And Items Of Interest In The Field

Carson Patent Infringement Suit Being Heard at Tucson

The patent infringement suit of the Carson Investment Company of San Francisco against the Phelps Dodge Corporation and the Calumet and Arizona Mining Company as co-defendants, is being heard before Judge William H. Sawtelle in the U. S. District Court at Tucson, Ariz.

On September 16, H. E. Elliott, chief counsel for the Phelps Dodge Corporation, gave formal notice that the defense would offer in evidence three reels of motion pictures showing smelting operations. Arthur Olsen, of Jones, Addington, Ames and Siebold, of Chicago, also attorney for the defense, made a strong plea to the court in favor of the admissibility of the cinema evidence. Judge Sawtelle, however, reserved ruling.

Procedure of the trial saw a continuation of the detailed technical testimony of John Moore Samuel, head of the investigation department of the reduction plant of the Phelps Dodge Corporation. His testimony largely concerned the Siemens reverberatory furnaces which the defense claims antedate the Carson patent.

A number of extremely realistic wooden models showing the furnaces with the charge material, metal bath, slag and brick accretions as they were when the furnaces were shut down, were introduced as evidence.

Mining Industry To Have Part In Future California State Fairs

Plans to have the mining industry take its share in the annual State Fair, commensurate with the part played by agriculture, were laid at a mining banquet held in the evening of September 10 at Sacramento, in connection with the California State Fair. Following action taken at this gathering, a committee is to be appointed by Drury Butler, secretary of the Mining Bureau of the Sacramento Chamber of Commerce, to further this project. Those in attendance favored a separate building at the fair for mining exhibits.

The rejuvenation and rehabilitation of the mining industry with the assistance of a sympathetic administration was the outlook for the future, as forecast by several speakers.

The banquet was attended by state officials, including Governor C. C. Young, and representative mining men from all parts of the state. Among the speakers were: Senator Tasker L. Oddie, of Nevada; Congressman Chas. F. Curry; Dean Frank H. Probert, of the University of California; Lloyd L. Root, head of the State Mining Bureau; Fred G. Stevenot, chairman of the Department of Natural Resources; Chester Miller, vice president of the Northern Section of the California Development Association; C. E. Jarvis, Sacramento banker; and Fred Shaffer, of the Los Angeles Chamber of Commerce.

"Geology of the Oil Shales of the Eastern United States" is the title of a report recently issued by the Kentucky Geological Survey. State Geologist W. R. Jillson, Frankfort, Ky., is the author.

ARIZONA CHAPTER MEETING

A PROGRAM of exceptional interest has been prepared for the fall meeting of the Arizona Chapter of the American Mining Congress, to be held at Globe, October 10 and 11. Papers to be presented will cover various phases of operations at the Inspiration, Miami, Old Dominion, and Magma mines.

The program of papers follows: "The Inspiration Leaching Plant," by H. W. Aldrich; "History of Development of the Undercut Caving Method," by Felix McDonald and J. L. Johnson; "Engineering Features of the Undercut Caving Method as Applied by Miami Copper Company," by A. J. McDermid; "Retreatment of Concentrates at Miami Copper Company," by H. D. Hunt; "Slime Filling for Extinguishing Mine Fires," by H. S. Duncan and A. H. Shoemaker; "Reverberatory Practice at the Magma Smelter," by H. J. Rose.

Ample opportunity will be afforded for the inspection of mines and plants of the district.

Entertainment will include a banquet at the Cobie Valle Country Club on the evening of October 10th.

Nevada Consolidated To Change Ruth Open Pit To Underground System

The installation of a new million dollar plant, designed for underground mining at the Ruth copper pit of the Nevada Consolidated Copper Company, near Ely, Nev., is now well under way, according to officials of the company. The plan contemplates a gradual change from steam-shovel, open-pit mining to underground mining with the branch raise system. According to estimates made by the officials, the new system will not be fully completed for about five years, but during the transition period surface mining will decrease and shaft operations will increase.

Among the interior improvements at the shaft will be solid concrete structure from the collar to the bottom, including the ore pockets and the approaches to the haulage ways. A substation of 7,500 k. v. a. capacity and a change house to accommodate 500 men are also being erected.

The Ruth pit, which is one of the largest surface mines in the world, is now 500 ft. deep, extends one mile east and west and one-half mile north and south. It has nine 50-ft. levels, and at the present time the daily output is 9,400 tons.

Utah Exhibits Minerals

With details rapidly being executed, indications are that the mines and minerals exhibit at the Utah State fair, October 1 to 8, will be one of the features of the forty-ninth annual state exposition. This will be the first attempt to get a comprehensive mineral exhibit in the history of the fair.

A. G. Mackenzie, member of the state fair board, in charge of the mines and

mineral exhibit and secretary of the Utah chapter of the American Mining Congress, states that the exhibit will include not only metals, coal and oil, but all minerals, such as building and ornamental stones, clays, slate, cement, plaster, gems and others of a multitude of minerals known to exist in Utah.

It will be the first public exhibition of mining machinery, which has been held at Salt Lake for many years.

Models of mines and at least one flotation plant are expected to be of unusual interest to visitors. The flotation plant will demonstrate the most interesting metallurgical developments in the state in recent years. There will be many other features of interest to the layman, as well as to those in the industry.

"It is our plan to give the layman an idea of the mineral industry and how it operates," Mr. Mackenzie said.

American Silver Producers to Meet

The annual meeting of the American Silver Producers Association is to be held at Salt Lake, October 10. Among the business to be taken up is the election of new directors.

According to W. Mont Ferry, president of the association, the advertising campaign carried on by the association jointly with the Silversmiths' Guild of America resulted in an increase of 12 percent in silver sales during 1926 as compared with 1925.

The membership of the association continues to show an increase. A total production of 95,000,000 ounces was represented by the association in 1926, as compared with 77,000,000 in 1925.

Manganese Inquiry

Agents of the Tariff Commission are expected to complete their field investigation on the manganese industry by early October. Thereafter a report on the manganese situation will be prepared and sent to Congress for its information and that of the public. The exact time of the publication of this report is uncertain, but it is likely to be early in the new year.

Commission officials state that producers of manganese and manufacturers of products in which manganese are used have an erroneous idea that the purpose of this inquiry is to change the import duty on manganese ore. Such is not the case. "The manganese producing and manufacturing industry should get away from the idea that this investigation contemplates any change in the duty," said an official of the commission. It is solely for the purpose of obtaining data as to the status of the industry.

The investigation is being conducted by a mining engineer, an economist and an accountant. The inquiry has been made in various parts of the United States, during which information has been obtained as to the manganese situation in foreign countries, including production and the effect of foreign imports on the American industry. The situation in the United States covering manganese ore resources and their methods of production has also been considered. Information is also being obtained as to research work on the treatment of manganese ores.

The American Manganese Producers Association, recently organized, has given considerable assistance to the commission in its investigation by making available all information in its possession and that of its members on the manganese industry. This assistance has gone to the extent of allowing agents of the commission to observe operations at manganese mines, to look over cost accounts and to make available all other information possessed by the producers. This assistance has been regarded as very helpful to the commission in its investigation.

SLIMING EXTINGUISHES ONE UNITED VERDE FIRE

THE use of slimes for extinguishing mine fires is proving successful at the United Verde mine, Jerome, Ariz., where fires have resisted every attempt at control for many years. One fire has now been extinguished and it is believed that the remaining fires will soon be controlled. Slimes are still being brought to the mine from the mill at Clarkdale, but a small crushing plant to produce slimes at the mine is nearing completion. Smoke and gas conditions in the open pit are already greatly improved.

Butte Manganese Development Proceeding Rapidly

The erection of a new manganese roaster and concentrator at Butte, Mont., by the Domestic Manganese & Development Company, is being followed with keen interest by those interested in the development of the domestic resources of manganese ores, as the success of this project will mean much to the manganese industry.

The work is proceeding rapidly, and the company expects to start shipments about the first of the coming year. The Chicago, Milwaukee & St. Paul is building a 3,200-ft. spur and trestle from its main line to the plant.

Mining Exhibit at Michigan State Fair

A comprehensive display of the industrial and economic importance of the mining industries of upper Michigan will be exhibited at the 1927 Michigan State Fair in Detroit by the Michigan College of Mining and Technology in conjunction with an exhibit by the Upper Peninsula Development Bureau. Prof. R. R. Seeber, of the Department of Mechanics and Electrical Engineering is arranging the exhibit, which will be an elaboration on last year's demonstration.

One of the outstanding features will be an electrified miniature mine in operation. Another feature of the exhibit will incorporate a detailed demonstration of the various phases in mining and concentrating copper and iron.

The economic importance of the copper and iron mining industries will be emphasized by statistical charts showing the dependency of industry generally on the production of copper and iron. These charts will show first the capital and labor employed in mining in the upper peninsula, and, after illustrating the distribution of the minerals, will show the steel, automobile and various other industries which furnish employment to much labor in the industrial centers are dependent to a large extent on the products of the mines of the upper peninsula of Michigan.

Map in Colors Shows Ore Distribution

A map showing distribution of Lake Superior, eastern and foreign iron ores for 1926, and location of consuming furnaces, has been issued by the Lake Superior Iron Ore Association, Cleveland. The map shows a heavy red line running from the Lake Superior ranges, with smaller branches and veins leading to lower lake ports and consuming points, each with the tonnages stated thereon. Eastern mines, their shipments and consuming districts and receipts and distribution of foreign ores are shown by means of blue lines and areas. The map makes it easier to visualize the distribution of iron ore than does the chart method, as used for the past several years.

Dividend disbursements by Utah mining companies during the first six months of 1927 have established a new post-war record, aggregating $7,830,334, as compared with $7,369,064 during the corresponding period in 1926.

The Tri-State Zinc and Lead Ore Producers' Association has issued its 1927 map of the Oklahoma-Kansas mining district. It shows location of all mills and side roads leading to the mills.

British Metals to Take Noranda Mines Output

It has been announced that Noranda Mines (Ltd.), Quebec, has made a contract with the British Metals Company, whereby the latter will purchase the entire output of blister copper from its smelter over a period of years. The Noranda Mines will not attempt to do any refining, not having sufficient output to warrant it. It is understood that the British company has made arrangements to have the blister copper refined in the United States. It is estimated that the output will be about 3,000,000 pounds of copper a month at the start. It is not expected that any customs ore will be available for at least a year other than that obtained from the two Noranda subsidiaries. The smelter will be ready by the middle of October and the Horne Mine is already sufficiently developed so that ore will be ready for the smelter at that time.

New Colorado Concentrating Plant

A contract has been awarded for the construction of a new fireproof concentrating plant at Nederland, Colo., for the Wolf Tongue Mining and Milling Company, at a cost of approximately $60,000. The mill is designed to have a capacity of 25 tons of ore every 24 hours and is to be completed by December 1, 1927.

Plans for the mill were drawn under the direction of Manager William Loach, who has been in constant association with the mining and reduction of tungsten ores for 20 years and is an authority on tungsten. The plant is to be built in separate units driven by individual motors. The company owns water power, capable of supplying 200 horsepower. Although this mill is of about the same size as that destroyed by fire two months ago, power requirements are only 60 percent of that used in the former plant and labor will be reduced by about one-half.

Corona Mercury Mine Leased

J. B. McCauley and associates of San Francisco have taken a five-year lease on the old Corona Mercury mine, which is 12 miles northeast of Calistoga, Calif. Equipment will be installed and new ground developed.

Active Development at American Flag Mine

Active development has been initiated at the American Flag mine at Camptonville, Nevada County, Calif. James Grimes, mining engineer, has recently been placed in charge of the property. The main tunnel has previously been driven 1,400 feet and a vein of quartz-gold ore opened.

MINERAL SEPARATION BY COLOR VALUES DEVELOPED AT MICHIGAN COLLEGE OF MINING

THE Department of Research of the Michigan College of Mining and Technology at Houghton announces the development of a new metallurgical process. The department's experimenters have succeeded in the separation of minerals and metals from gangue or waste on the basis of the color values of the minerals selected. Experiments on the copper concentrates of the Lake Superior District containing silver in small crystals give satisfying results in the saving of the precious metal. This metal now is almost a total loss to the mines in that it is allowed to go into the copper and is sold as copper at the current price for the red metal. The loss from this source in the district approximates a quarter of a million dollars annually.

In addition to the silver, dry placer material can be worked. Platinum, gold, etc., may be extracted from the deposits in localities where water is impossible to obtain. The cleaning up of concentrates and the removal of certain objectionable impurities in finished products now made by the gravity and other systems is another field of application for the new method.

An important advantage of the method is that the valuable concentrates are constantly under cover, and no opportunity is available for the pilfering of the slightest amount. Water is not necessary in the concentration, as the new process functions entirely on the color or light reflecting value of the mineral.

The machine used consists of a traveling belt, which passes under a series of light, sensitive cells. These cells actuate a relay system, which, in turn, mechanically removes any particle whose color tone or light reflecting value is of the particular amount for which the relay is set. The cost of operation of the system is very low.

Dr. W. O. Hotchkiss, president of the college and director of research, sees in the application of this principle a new field for ore dressing research, and has expressed the hope that even other mineral properties may be investigated to give the ore dresser additional tools with which to attack refractory extractions. The process is the invention of Prof. A. T. Sweet, of the metallurgical staff.

Increasing Mill Capacity at Three Queens Mine

The capacity of the mill at the Three Queens mine of the Four Aces Mining Co., near Volcano, Calif., is being increased from 50 to 150 tons daily. The erection of an 1,850 ft. aerial tramway from the Scorpion workings to the mill has been practically completed. Power supply is being increased by the installation of an additional water wheel at their plant on Volcano Creek. Increased production will follow the completion of these improvements.

Yellow Pine to Improve Concentrating Plant

The Yellow Pine Mining Company, Goodsprings, Nev., is making preparations to add electrical equipment to the new lead-zinc, 60-ton concentrating plant that is expected to go into commission soon. In order to provide for more economical operation, the power units of the mine and mill have been centralized and skip pockets have been established at points in the incline shaft, enabling the management to secure increased ore output with the employment of less labor.

Sentinels of Safety Trophy Presented To Muncie Mine

The Sentinels of Safety trophy and the John A. Holmes certificate of merit were presented to the Muncie mine of the Federal Mining & Smelting Company, winner in the metal mining group of the National Safety Competition for 1925, at a meeting of the Tri-State Section of the American Zinc Institute at Picher, Okla., September 14. Dr. F. V. Meriwether, of the Bureau of Mines, presented the trophies and stated that Muncie's accomplishment of going 41,000 consecutive man shifts without a lost-time accident, plainly showed that the men working at the mine were interested and took an interest in safety work.

The cost of producing a ton of concentrate (lead and zinc) in the Tri-State district in July was $41.83, as compared with $42.14 in the previous month, according to averages compiled by the Tri-State Zinc and Lead Ore Producers' Association. The July costs were the lowest since August, 1924, when the association's figures showed an average cost of $41.01.

Richmond Iron Co. Completes Improvements

A campaign of rebuilding and rearrangement of mining plans by the Richmond Iron Co. (the M. A. Hanna Co.) of its iron ore mine at Palmer, Mich., on the Marquette iron range has been completed. The new arrangement makes possible the mining of open pit and serving the crushing plant from either direction. As the track is continuous it permits trains to travel consistently in one direction.

The building campaign has included a crushing plant, new buildings, and new pit equipment.

Wade Mine Starts Shipping

The Wade iron mine, situated near Buhl, Minn., on the Mesabi range, entered the shipping list early in September, for the first time this season. This property is operated by the open-pit method, by the Cleveland-Cliffs Iron Company, and is served by the Great Northern Railroad. The Wade mine shipped 24,986 tons in 1926. All of the Wade location houses have recently been repaired and the mine pit enlarged by A. Guthrie & Co., Inc., who have a contract for stripping and mining this property.

Spencer S. Rumsey Dies in Chicago

Spencer S. Rumsey, Duluth, chief engineer for the Oliver Iron Mining Company for 16 years, died in Chicago on Thursday, September 8, at the age of 51 years.

He entered the employ of the Oliver Iron Mining Company at Ironwood, Mich., in 1899. In 1911 he became chief engineer for the company and held that position at the time of his death.

Canadian Mineral Output Lower

Mineral output of Canada for the first half of 1927 was valued at $56,468,412, as compared with $61,249,482 for the same period of 1926, according to the Department of Commerce. Last year was a record year in the mineral production of Canada, and although this year's production is almost 8 percent less, the outlook is reported decidedly favorable in Canada.

Lead Report

The Department of Commerce in its "Commerce Yearbook" for 1926 states that although the known lead deposits of the world are gradually becoming exhausted of cheaply produced ore, the past two years have shown that under favorable price conditions production increases. It is stated that the paint and pigment industry, which was formerly the greatest consumer of lead, is fast shifting to substitute raw materials, giving first place to the storage battery industry in 1926. "More efficient methods of collecting and reclaiming used lead are making greater supplies from that source available from year to year," says the Yearbook. "For some time the lead industry of the United States has had visions of the exhaustion of its greatest ore deposits and many of these mines have already exhausted their supply of 4, 6 and 8 cent lead, but could produce a large tonnage of 10, 12 and 14 cent and a greater amount of 20 and 30 cent lead. The lead industry for 1926 was in an extremely healthy condition. Secondary lead can be looked forward to as a very great factor in the future."

NORTH IDAHO MINING EXPENDITURES IN 1926

The following figures, compiled by the Idaho Mining Association, Ravenel Macbeth, secretary, show the expenditures of non-producing development companies and producing non-dividend paying companies, together with the expenditures for assessment work and new claims located in northern Idaho in 1926. The report covers operations in Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, Nez Perce, and Shoshone Counties. The last table gives the total expenditures for previous years, and discloses a considerable increase during 1926.

NON-PRODUCING DEVELOPMENT COMPANIES AND PRODUCING NON-DIVIDENT PAYING COMPANIES, ASSESSEMENT WORK AND NEW CLAIMS LOCATED

Benewah		
4 companies	$8,680.00	
Assessment work-location work	3,170.00	
		$11,850.00
Bonner		
37 companies	296,500.00	
Assessment work-location work	23,060.00	
		319,560.00
Boundary		
18 companies	258,080.00	
Assessment work-location work	18,950.00	
		277,030.00
Clearwater		
12 companies	35,810.00	
Assessment work-location work	4,160.00	
		39,970.00
Idaho		
44 companies	123,750.00	
Assessment work-location work	36,670.00	
		160,420.00
Kootenai		
17 companies	34,600.00	
Assessment work-location work	19,330.00	
		53,930.00
Latah		
3 companies	3,400.00	
Assessment work-location work	3,480.00	
		6,880.00
Lewis		
1 company	2,000.00	
		2,000.00
Nez Perce		
3 companies	9,500.00	
Assessment work-location work	2,650.00	
		12,150.00
Shoshone		
252 companies	4,204,234.00	
Assessment work-location work	367,280.00	
		4,571,514.00
Total, North Idaho		$5,455,304.00

	Itemized
Labor	$2,952,589.00
Supplies	1,546,172.00
Mine equipment	337,204.00
Mill equipment	292,476.00
Power plants	14,380.00
Ore transportation	312,483.00
Total, North Idaho	$5,455,304.00
391 companies employed	1,378 men
Assessment work-location work employed	192 men
Total number employed	1,570 men

Assessment work performed on 4,557 claims owned by individuals.
Location work performed on 686 new claims located by individuals.

North Idaho Similar Expenditures 1923-1924-1925-1926

1923	$4,347,821.00
1924	3,355,083.00
1925	4,825,483.00
1926	5,455,304.00
Total	$17,983,691.00

Kellogg Electrolytic Plant Progressing

Construction of the electrolytic plant at Kellogg, in the Couer d'Alene district of Idaho, is progressing according to schedule, and is expected to be completed by the end of the year. The plant, owned by the Bunker Hill & Sullivan and the Hecla Companies, will produce 50 tons of zinc a day at the start.

PERSONAL ITEMS

Walter Douglas, president of the Phelps Dodge Corporation, was elected president of the Old Dominion Company at a meeting of the board of directors recently in New York. He succeeds the late Charles Summer Smith, whose death occurred at Lincoln, Mass., August 28.

Cleveland E. Dodge, vice president of the Phelps Dodge Corporation, was elected vice president of the Old Dominion Company also.

J. T. Shimmin has resigned his position as superintendent of mills of the Nevada Consolidated Copper Company Chino mines and joined the staff of the Southwestern Engineering Corporation as metallurgical and sales engineer with offices in the Hollingsworth Bldg., Los Angeles.

James E. Jopling, for many years chief engineer of the Cleveland-Cliffs Iron Company, has retired, but will continue with the company in a consulting capacity. No announcement has yet been made as to his successor.

Joseph D. Grant, first vice president of the Columbia Steel Corporation of San Francisco, has been elected president to succeed the late Wigginton E. Creed.

Arthur Notman, consulting mining geologist and engineer, recently visited the Park City, Tintic, and Bingham Districts of Utah.

Maj. Robert H. Dickson, manager of the Verde Central Mines at Jerome, Ariz., and Mrs. Dickson are in France. Major Dickson was a delegate to the American Legion Convention from Arizona.

P. G. Beckett, Bisbee, Ariz., general manager of the Phelps Dodge Corporation properties in the West, sailed for Europe early in September.

W. J. Michels, E. M., formerly assistant engineer with the Tennessee Copper Co., at Ducktown, Tenn., has entered the employ of the Wisconsin Steel Company iron mines at Nashwauk, Minn., Mesabi iron range.

M. E. Frank, Hibbing, Minn., formerly employed with Great Northern Iron Ore Properties, has succeeded George O'Brien as engineer with the Donner Mining Co., operating on the Mesabi iron range.

H. O. Johnson, formerly with the U. S. Geological Survey and also a lecturer at the University of Cincinnati, will be connected with the New Mexico School of Mines as geologist during the coming year. Mr. Johnson is at present investigating the fluorspar deposits in Hidalgo County.

Frederick Laist, metallurgist for the Anaconda Copper Mining Company, Anaconda, Mont., has returned from a trip abroad.

It is reported that S. G. Burt, of Los Angeles, has been engaged to film hydraulic mining scenes at the Omega mine in Nevada County, Calif. This film is to be used in an educational campaign on hydraulic mining.

MINERAL PRODUCTION OF UNITED STATES SHOWS SUBSTANTIAL INCREASE IN 1926

IN 1926, the industries producing minerals in the United States and preparing or reducing them for use were, as a whole, maintained at a higher level of productivity than during 1925, a year of marked prosperity and high records in output, declares Frank J. Katz, head of the Division of Mineral Statistics, Bureau of Mines, in a review just made public. Only a few important products deviated sharply from this general condition.

Measured by total value of mineral products—$6,262,000,000—the output of 1926 was the next largest ever recorded. Although the corresponding figure for 1920 is $6,981,340,000, price levels have so declined since that year, when they were at their peak, that the real value of the nation's mineral production for 1926 represents at least an appreciable, if not a substantial, increase over 1920. As compared with the values of the total mineral output for 1923, 1924, and 1925, in which years the average price levels of all commodities were not materially different from that of 1926, increases of 5 percent, 18 percent, and 10 percent, respectively, are indicated.

COAL

All the mineral fuels were produced in larger quantities in 1926 than in 1925. The total output of bituminous coal closely approximated the war record and exceeded the record made in 1923, a more normal year. Anthracite production was evenly maintained at a good rate after the strike settlement late in February. The year was otherwise free from domestic coal-mining disturbances. Consumption was high, exports during much of the year were extraordinarily heavy because of the strike in Great Britain, and demand was further augmented by heavy buying for storage.

PETROLEUM

A new record in the output of crude petroleum was attained by gradual increase throughout the year; nevertheless, stocks of crude petroleum were considerably reduced throughout the year, thus reflecting the growing refinery throughput and heavier demand for refined products. Prices in general were above those for 1925. Increases in the production of natural gas and its coproducts, natural-gas gasoline and carbon black, are recorded for 1926.

METALS

The aggregate value of the output of metals in the United States in 1926 showed a small increase over 1925. Among the metals of major importance, the most notable large increase was shown by zinc, whereas gold and silver showed notable decreases. The production of gold continued the decline which set in about 1916. The average price of silver in the United States in 1926 was 7 cents an ounce less than in 1925, causing a decrease of about one-seventh in the total value and a smaller but appreciable decrease in the quantity produced.

The domestic production of copper increased moderately. Imports of copper into the United States were larger, whereas the slackening of foreign demand is indicated by smaller exports. A marked increase in domestic demand was, however, insufficient to offset these factors, and domestic stocks increased. The price trend was very slightly downward.

The lead and zinc industry in 1926 was characterized by record production, intense activity, high prosperity, and excellent demand, although price levels were slightly lower than in 1925 and declined during the year.

In magnitude of production, the iron and steel industry recorded a remarkable year in 1926. The production of steel was the largest ever recorded, and the production of pig iron was only a little less than in 1923, the record year. The output of iron ore was notably greater than in 1925 but still well below 1917, the banner year. The average price of ore for 1926 was virtually the same as in 1925. Prices for iron and steel were slightly lower, however, and consumption slightly higher.

MANGANESE

The outstanding features with respect to manganese in 1926 were the smaller domestic production of high-grade ores, the extraordinary figures for the production of ferromanganese based on imported ores, the stable demand for manganese and manganese products, and the downward tendency of prices. The domestic production of mercury also decreased, but larger imports indicated corresponding increases in consumption, and prices rose materially during the year. There was virtually no production of chromite in the United States in 1926, but important increases in imports and the growing use of chromite as a refractory material are noted. Antimony mining and smelting in the United States in 1926 was at low ebb, despite the growing demand, which was met by increased imports from Mexico and Bolivia in addition to the Chinese supply. Prices were lower than in preceding years. Aluminum was produced in the United States during the year at about the same rate as in 1925; there was also little change in price.

FIRST GOVERNMENT POTASH TEST ENCOURAGING

THE results of the first Government test made under the Federal potash act are both interesting and encouraging, though the beds encountered are probably not rich enough to have present commercial value, according to a statement by the Department of the Interior.

The tests, which take the form of core drilling, are made cooperatively by the Department of the Interior and of Commerce. The Geological Survey selects drilling sites, studies and analyzes the cores, and reports the results of the investigation. The Bureau of Mines negotiates the necessary contracts, conducts the drilling operations, and delivers the cores to the Survey.

The first core test was made on public land in the NW. ¼ sec. 13, T. 17 S., R. 31 E., Eddy County, New Mexico. The site was not the first choice of the Geological Survey or even the fifth choice. The restrictive language of the act under which the well was drilled required that all lessees or owners of lands or of mineral rights within a radius of one mile of any proposed site must sign contracts of agreement to reimburse the Government for the costs of exploration before any work could be started. No landowner or lessee cared to sign such a contract, so that the cooperating departments were automatically excluded from areas where the better showings had been indicated by drill cuttings. Under the conditions named it is surprising that the results obtained are so favorable as they are.

About 50 beds or groups of beds containing 2 percent or more of potash (K_2O) were encountered between depths of 838 and 1,770 feet. The depth of the hole was 1,847 feet. Fourteen beds ranged in thickness from 1 inch to 6 feet 2 inches and in potash content from 3.10 to 16.47 percent.

Polyhalite is the most abundant potash-bearing mineral found in the cores. It occurs in red, brown, salmon, orange, and white colors and ranges in texture from granular to waxy. It occurs in beds, in seams, in irregular masses or blotches associated with anhydrite or halite, in masses interwoven with anhydrite, and in disseminated grains. Sylvite was found in minor quantity at depths of 906, 908, and 1,018 feet. It is not in beds but forms spots or inclusions in anhydrite and in halite. Carnallite forms thin rich beds and in addition occurs in seams, plugs, and irregular masses. This is the first occurrence of carnallite noted in the samples from the Texas-New Mexico field that have been examined by the Geological Survey. Carnallite is one of the principal potash-bearing minerals in the German field. Its occurrence in New Mexico in definite beds, even though the thickest shown in the core is only 8 inches, leads to the hope that as exploration progresses beds of minable thickness will be found. Kieserite and magnesite are magnesian salts that occur in thin layers, seams, and irregular masses in the core. These salts, which contain no potash, have scientific interests but are not present in sufficient quantity to have commercial value. Anhydrite and halite are abundant and occur in various mixtures or arrangements with the potash-bearing salts.

Tests for boron were made on nearly all the samples. Many of these were negative and none yielded more than about 0.1 percent B_2O_3.

In addition to the study of potash-bearing cores the Geological Survey is continuing its examination and analysis of cuttings from wells drilled for oil in potential potash territory, because information from such sources extends knowledge of the potash field and is essential as the basis for the further selection of sites for core drilling under the potash act.

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN WASHINGTON IN 1926, BY COUNTIES

(In terms of recovered or recoverable metal)

Advance figures by C. N. Gerry, of the United States Bureau of Mines

County	Number of producers	Ore treated Short tons	Gold* Fine ounces	Silver* Fine ounces	Copper Pounds	Lead Pounds	Zinc Pounds	Total value
Clallam	1	.....	4.55	.....	.....	.....	.....	$94
Ferry	9	17,597	7,585.30	59,160	179	17,568	.....	195,148
King	1	60	86.98	882	522	.....	.....	2,421
Kittitas	4	.....	1,329.34	452	.....	.....	.....	27,762
Okanogan	5	18	18.33	188	190	3,312	.....	788
Pend Oreille	12	813	4.59	1,818	177	326,931	65,485	32,313
Pierce	1	7	.....	5	867	.....	.....	125
Snohomish	2	25,290	190.98	18,451	1,347,678	.....	.....	204,136
Stevens	22	10,558	117.94	90,693	2,337	4,198,417	978,869	468,646
Whatcom	1	.....	2.81	.....	.....	.....	.....	58
Total, 1926	58	54,343	9,340.82	171,649	1,351,890	4,546,228	1,044,354	†931,491
Total, 1925	46	50,287	11,138.49	166,425	1,159,057	5,627,241	1,217,846	‡1,092,464

* Includes placer production.

† Average value of metals: Gold, $20.671835 per ounce; silver, $0.624 per ounce; copper, $0.14 per pound; lead, $0.08 per pound; zinc, $0 075 per pound.

‡ Average value of metals: Gold, $20.671835 per ounce; silver, $0.694 per ounce; copper, $0.142 per pound; lead, $0.087 per pound; zinc, $0.076 per pound.

Contract Awarded for Drilling Fourth Well

A contract for the drilling of potash test well No. 4, in Ector County, in central western Texas, has been awarded to the Pennsylvania Drilling Company of Pittsburgh, Pa., by the Bureau of Mines. This well will be the first to be drilled in Texas in the course of the Federal Government's program, the other three test wells having been sunk in New Mexico. This well is also the first to be drilled on privately-owned land, other wells having been drilled on lands owned by the Federal Government.

The well for which contract has just been let is the last of four test wells contracted for under the 1927 appropriation. For the fiscal year 1928, the sum of $100,000 has been made available for potash exploration purposes. It is probable that the drilling program will be continued, for the greater part, in the state of Texas.

James S. Wroth, engineer in charge of potash investigations for the United States Bureau of Mines, is actively supervising all drilling operations. General supervision of the Bureau's part of the potash exploration program has been entrusted to J. H. Hedges, Assistant to the Director, Bureau of Mines.

Iron Ore Shipments

Iron ore shipments from Lake Superior district for the present season of navigation will approach 50,000,000 tons, according to latest estimates. This would be about 10 percent less than last year's total. Mining men had hoped to exceed last year's figures as the start in movement down Lakes was three weeks earlier, but some curtailment has recently taken place. Oliver Iron Mining Co. and some of the independents have moderately reduced operations on the ranges.

U. S. Gypsum Co. Mine

With the opening at Plasterco, Va., of the No. 6 mine of the United States Gypsum Co., this community of 500 persons becomes the site of what is said to be the deepest gypsum mine in the world. The shaft of the mine descends 560 feet.

Hundreds of thousands of tons of gypsum rock are mined annually in this corner of Virginia. At the manufactory of the United States Gypsum Co. this rock is made into gypsum wallboard, gypsum sheathing, rock lath, gypsum plasters, and dozens of other gypsum products.

With the completion of sinking operations on the Kennedy Mining & Milling Co. property at Jackson, Calif., the depth of the perpendicular shaft of the Kennedy mine is now 4,764 feet, the deepest gold mine shaft in the West.

SURVEY OF COAL SITUATION

A survey of conditions in the unionized bituminous coal fields, the results of which are published in a bulletin just issued by the Department of Natural Resources of the Chamber of Commerce of the United States, discloses that the miners' strike is dragging on toward the establishment of a record for length with little disturbance to industry as a whole.

"The present strike," says the Department, "has thus far differed from other strikes mainly in the following respects: practically no derangement to industry, the lack of alarm on the part of the general public, and the lesser degree of violence."

An interesting development of the present strike, it is observed, is the trend toward splitting into a series of sectional controversies while in former suspensions a national aspect has been maintained. Conditions in some of the sections are summarized as follows.

In Central Pennsylvania, where work ceased under a temporary agreement in July, a number of operators are reported to be starting again on an open shop basis.

In Western Pennsylvania a number of mines have started on the open shop basis.

In West Virginia, most of which is non-union, production has gradually increased since the expiration of the Jacksonville agreement.

In Eastern Kentucky and in Virginia non-union fields have also increased their production.

In Western Kentucky, which became non-union several years ago, production has been doubled.

In Illinois, a strong union district, operations have virtually ceased.

In Indiana, also a strong union district, some operators have signed up with the union and a few are working on the open shop basis. Production is two-thirds of normal.

In Ohio, also a union district, a few operators are working on an open shop basis. Production is about 30 percent of normal.

Other coal producing districts in the South, the Middle West and the West show in the aggregate little change, and are continuing their usual production of one and third million tons weekly.

"Although existing stocks," the bulletin says, "will indicate a comfortable reserve for present requirements, the question remains whether the increased consumption will be supplied from production or from stocks. It must be borne in mind that most of the stocks are in the hands of individual consumers and will not be available to the general public."

Pittsburgh Coal Co. Improving Crescent Mine

The Pittsburgh Coal Co. is planning extensive improvements at its Crescent mine, California, Pa., including screening, picking and loading equipment for a rail-and-river tipple to handle 5,000 tons daily output from the mine. The screening and picking for this tonnage will all be accomplished by a single Marcus picking table screen placed in the river portion of the tipple and after being prepared the coal will be loaded into barges by extra long loading booms. When the coal is being loaded out by rail the different sizes will be carried by belt conveyors up and back of the railroad tracks and loaded out by standard loading booms.

The unique feature of the plant is that any of the sizes may be loaded not only alternately, but any combination of the sizes or part of them may be loaded on either the barges or railroad cars at the same time.

The Bureau of Mines has issued a tabular report showing the production, value, men employed, days worked, and output per man per day at coal mines in Ohio, in 1926, by counties.

Mine Exhibit at Ohio State Fair

One of the unique displays at the Ohio State Fair, August 29 to September 2, was a complete mining plant, to acquaint the public with the methods of mining in Ohio. The tipple, shaker screens, loading booms, and mine cars were all complete and were operated by electricity. The plant was a copy of the W. S. Harman Coal Co. plant at Baird's Furnace, Ohio. Every detail was carefully worked out and an actual demonstration of coal mining was given. This is the first time that a coal-mining exhibit has been arranged for the Ohio fair.

Fuel Exhibit at Power Exposition

The coming Sixth National Exposition of Power and Mechanical Engineering will exhibit the latest and most approved devices for burning and handling all fuels, the various stages of consumption and the measurements and chemical reactions as they occur along with the mechanical equipment used in every stage that the ingenuity of man has perfected. The exposition is to be held at Grand Central Palace, New York, December 5 to 10, 1927.

Standardization of Electric Motor Frames

Standardization of certain important dimensions governing the interchangeability of electric motors of different makes has made a forward step, according to an announcement by the American Engineering Standards Committee, with the recent acceptance by two prominent organizations, the American Society of Mechanical Engineers and the National Electrical Manufacturers' Association, of joint leadership in the development of such standards.

The National Machine Tool Builders' Association, who found diversity in motor dimensions a problem of particular difficulty in their industry, filed the original request to have the subject taken up by the American Engineering Standards Committee.

The National Electrical Manufacturers' Association and the American Society of Mechanical Engineers have been appointed joint sponsors for the project. These bodies are now proceeding to the organization of a sectional committee to take up the technical work.

Wiring Materials and Devices

Arrangements have been made for the development and revision of specifications and standards for electrical devices and materials with relation to fire and casualty hazards, under the procedure of the American Engineering Standards Committee and the sponsorship of the Underwriters' Laboratories.

Orr Heads Utah Association

James M. Orr, Morgantown, W. Va., formerly assistant secretary of the Monongahela Operators' Asosciation, has been elected executive secretary of the newly organized Utah Coal Operators' Association, taking charge immediately.

Mr. Orr is a mining engineer and has had a great deal of experience not only in mining and handling coal, but especially in developing the manufacture of coal by-products. In association with John Fulton, a noted engineer in the eastern coal mining region, Mr. Orr helped erect one of the first by-product coal plants in America, in Johnstown, Pa., for the Cambria Steel Co. In addition, Mr. Orr has held many important positions with coal mining companies in West Virginia. He was at one time vice president and general manager of the Hudson Coal Co., of Clarksburg, W. Va.

"The work of the association will be solely toward developing the Utah coal industry," says Mr. Orr. "The association will have nothing to do with prices. The older associations in the east have avoided any action relating to prices and have confined themselves to other useful functions.

"That is to be the policy here. Our study will be ways of producing a more economical supply of coal, extending the market for the product of Utah mines, investigation into the extent and adequacy of the coal car equipment of the railroads serving the mines of this state, gathering information concerning the extent of Utah's coal deposits, and otherwise doing things which will be of advantage to this important Utah industry."

Ohio Foreman and Fire Boss Exams

The Ohio Department of Mining will start the latter part of the year, through the deputy inspectors, to give examinations for foremen and fire bosses, under the provisions of the new law. The law provides that after January 1, 1928, no one can act in those capacities without having passed an examination and received a certificate. Jerome Watson, chief inspector, recently called his deputies for a conference, when arrangements were made to give the examinations.

Plans Laid for Second International Coal Conference

Dr. Thomas S. Baker, president of the Carnegie Institute of Technology, recently returned to Pittsburgh after a visit of two months to France and Germany, where he made preliminary plans for the International Coal Conference to be held in Pittsburgh, November, 1928. "The last conference here created a deep impression in Europe," Dr. Baker says, "and we look for a much larger foreign representation in 1928. European scientists appreciate that coal is not merely a fuel, but contains the raw products to make many other things, notably synthetic fertilizers."

U. S. Steel Gets Greene County Lands

Activities of the United States Steel Corporation in the Whiteley Township section of Greene County, Pa., through its subsidiary, the Cumberland Coal Co., are believed to forecast the development of a huge acreage now held by it within the next few years. The Cumberland Co. now has a total of 65,000 acres of virgin bituminous coal in that section, recently acquiring the John A. Lantz farm of 400 acres, the last large tract still in the hands of the land owners. The price paid was $1,000 an acre and it is believed to be the largest price ever paid a land owner in Greene County. The right of way has already been secured for a railroad which would run up the valley of Big Whiteley Cree, in which many holdings of the United States Steel Corporation are located.

Fuel Engineering Course at Penn

A course in fuel engineering, far in advance of anything yet attempted in fuel development and conservation, will be inaugurated at the University of Pennsylvania with the opening of the 188th academic year, September 30.

The new fuel engineering course will be in charge of Prof. Robert H. Fernald, director of the department of mechanical engineering in the University's Towne Scientific School.

Requirements for entrance include a baccalaureate degree from an approved institution in a course embracing individual courses in chemistry and physics.

PULVERIZED COAL TESTS

TESTS recently made at the Philadelphia Navy Yard in the use of pulverized coal for marine purposes have so successfully demonstrated the feasibility of the use of this fuel, that it has been decided to fit up the merchant marine freighter, "Mercer," with burners, pulverizers and coal conveying machinery and make a trans-Atlantic voyage, probably sometime during November. It has been estimated that the successful use of pulverized coal will result in the consumption of between 8,000,000 and 10,000,000 tons more of bunker coal annually.

Similar tests under the boilers of the Mississippi-Warrior Service steamship, "Illinois," on a trip from New Orleans to Baton Rouge, was reported to the War Department, September 21, by Maj. Gen. T. Q. Ashburn, chairman of the Inland Waterways Corporation. General Ashburn said that substitution of powered coal for oil on the river towboats would bring about a reduction of fuel costs of from 30 to 50 percent.

National Coal Committee Meetings

H. A. Glover, vice president of the Knox Consolidated Coal Company, of Indianapolis, and chairman of the marketing committee of the National Coal Association, has directed a call for a meeting of that committee at the William Penn Hotel, Pittsburgh, October 4. At a meeting of the marketing committee last spring a recommendation was made that in addition to the meeting of bituminous coal sales managers and agents, which was held at Chicago in connection with the tenth annual meeting of this association, a number of similar meetings be held in various parts of the country where there might be gathered those having quite common problems. The question of time and place, as well as the program for one or more such meetings, will receive consideration by the committee at its coming meeting. Further, there will be considered many suggestions that have reached the committee since its last meeting.

The tax committee of the National Coal Association is to meet at the association offices in Washington, Tuesday, October 11. Otis Mouser, president of the Stonega Coke & Coal Company, of Philadelphia, is chairman of the committee.

Williamson Operators Entertain Cincinnati Purchasing Agents

At the invitation of the Williamson, W. Va., Coal Operators' Association, of which George Bausewine, Jr., is secretary, and in the company of officials of the Norfolk & Western Railroad, 50 members of the Cincinnati Purchasing Agents' Association visited the Williamson field, September 14. Visits were made to the properties of the Tierney Mining Company, Sudduth Fuel Company, Red Jacket Consolidated Coal Company, Sycamore Coal Company, Landstreet-Downey Coal Company, and William Ann Coal Company. A banquet was served at the Mountaineer Hotel. George Dunglinson, Jr., Norfolk & Western Fuel Department, acted as toastmaster.

Loraine Coal & Dock Offers Men Work

Early in September the Loraine Coal & Dock Company of Columbus, posted notices at its five mines in Belmont County, Ohio, offering work to its men, who in normal times total 2,500, at the wage scale now paid by the Pittsburgh Coal Company. The scale provides for $6 per day for drivers, 14.4 cents per ton for cutting, and 65 cents per ton for loading. The offer is slightly higher than the scale formulated by the special scale committee of the Ohio Coal Operators' Association.

The American Eagle Colliery Company, operating mines on Clear Fork, Raleigh County, W. Va., with an output of 800 tons a day, has been sold to S. Peabody, of Chicago.

The Jeddo Coal Company is to ask for bids soon for the driving of a tunnel 600 ft. long through the lands of the George Moorehart estate, Jeddo, Pa., the tunnel tapping the rich coal on these lands. The coal will be taken to the Oakdale Breaker No. 4 for preparation.

Maher Receivership Asked

Application for a receivership of the Maher Collieries Co. has been made in the Federal court at Steubenville, Ohio. The case was set for hearing September 6, but was postponed. This company was formed in 1902 and incorporated in 1913, and between August 29, 1913, and March 31, 1923, paid dividends aggregating $688,776. Thomas K. Maher, of Cleveland, heads the company, which owns 7,000 acres of coal lands in Belmont County, Ohio, and controls the Marcoll Coal Co. with a daily normal output of 5,000 tons, and has an annual production capacity of 1,250,000 tons.

Mine Property Ordered Sold

An order was recently entered by Judge W. E. Baker in the United States District Court, at Elkins, directing the sale of the property of the Richland Coal Co., comprising three large mines and several thousand acres of coal land in Ohio and Brooke Counties, W. Va. The properties are valued at more than $1,000,000 and are to be sold to satisfy the claim of the Fidelity Philadelphia Trust Co., of Philadelphia, Pa., trustee, holding a mortgage deed of trust for $1,200,000.

Development of Fire Creek Seam Draws Attention in West Virginia

The concentrated attention of McDowell County, W. Va., coal operators is focused on the development of the Fire Creek seam of coal in the vicinity of Dowell County for the first time a few months ago. Likewise the people of Big Sandy district are looking forward with optimism to increased activity and prosperity as a result of the expected exploitation of the new vein. The distinction of shipping the first Fire Creek coal from McDowell County will probably go to the Pocahontas Fire Creek Fuel Corporation, which expects to be shipping coal from its new operation at Roderfield in the near future. The Roderfield Pocahontas Coal Co., at present mining the Warrior seam of coal at Roderfield, has announced that it would start sinking a shaft this month to the new bed of coal which underlies the property of the company. The same tipple will suffice for the mining of both seams.

To Study Coal Industry's Needs

John C. Brydon, former president of the National Coal Association, has been retained by the Baltimore and Ohio Railroad Co. to investigate and find what the Baltimore and Ohio can do to serve and protect its shippers. Mr. Brydon will study coal's needs and work out with the railroads a plan as to what it should do.

WEST VIRGINIA'S SECOND ANNUAL SAFETY MEET

WEST VIRGINIA'S Second Annual Safety Meet more than fulfilled the expectations of those who so diligently planned the event. On September 17 all roads led to Morgantown, and the result was that a record crowd was on hand to witness the contests in which 140 white-clad teams participated. West Virginia's coal production figures for Saturday, September 17, are the mute evidence of the success of the occasion, estimates showing a decrease of about 20 percent as compared with the production of other Saturdays.

The team representing Mine No. 63 of the Consolidation Coal Company, from Monongah, Marion County, was judged the most perfect first-aid team in the state and was awarded the Governor's cup. This team also won the cup offered by *The Fairmont Times* for the best team in Marion County.

The Monongah team and one representing the C. H. Mead Coal Company, East Gulf, were tied at 100 percent for first honors. In the work off of the tie the Mead Company's crew was awarded second prize.

Other ratings were as follows: Third prize, Kelley's Creek Collieries Company, Ward, W. Va.; fourth prize, Continental Coal Company, Monongalia County; fifth prize, New River Coal Company's team from Skelton.

One of the principal features of the meet was the official presentations of the Sentinels of Safety Trophy awarded by *The Explosives Engineer* to the winning mines and quarries in the National Safety Competition conducted by the United States Bureau of Mines.

The bituminous coal mine and the quarry which led their respective groups in this competition for 1926 are both situated in West Virginia. The No. 6 mine of the United States Coal and Coke Company, Gary, W. Va., was awarded the trophy for the second time; and the Berkely Quarry at Martinsburg, the 1926 winner, is operated by the North American Cement Corporation, who also won the trophy the preceding year at their quarry in Hagerstown, Md.

W. W. Adams, supervising statistician, Mineral resources Division of the United States Bureau of Mines, presented the trophies to the two winning companies. He also personally visited the mine and quarry and gave to each employe of the winning plants a certificate of honor signed by the Director of the Bureau of Mines.

At the conclusion of the Safety Day observance, West Virginia's largest industry voiced its appreciation of the contribution made to the cause of safety in mining by Robert M. Lambie, chief of the State Department of Mines. This was the presentation of a plaque, with Mr. Lambie's profile in relief, bearing the following inscription:

ROBERT M. LAMBIE
WEST VIRGINIA
DEPARTMENT OF MINES
PRESENTED BY AN APPRECIATIVE INDUSTRY IN RECOGNITION OF CONSTANT DEVOTION TO THE CAUSE OF SAFETY

In presenting the plaque, Walter H. Cunningham, secretary of the West Virginia Coal Association, said in part:

"The coal industry of West Virginia takes this advantage to extend a merited meed of commendation to a leadership so unselfishly shown as to have mounted above the reach of envy; to present to you a memorial in imperishable form as a measure of our personal esteem of one who has never faltered, when sacrifice was imminent and demanded, to offer himself at the altar of duty to save the life of a fellow worker. 'Greater love hath no man than this,' is recorded as the noblest attribute of mankind.

"The coal industry of West Virginia would not be unmindful of the Chief Knight in the lists of safety, whose work never ends, who is unsatisfied with even a splendid showing, and is ever seeking for the perfect score under actual industrial endeavor."

In addresses before the contest, Governor Howard M. Gore, Harry L. Gandy, secretary of the National Coal Association, and J. G. Bradley, president of the West Virginia Coal Association, lauded the showing West Virginia had made in safety work, stressing the need for further investigations in roof control in mines to reduce the number of accidents from falls of roof and coal.

Bluefield, Mercer County, was selected as the location for the third annual safety meet, according to an announcement by Mr. Lambie, head of the Department of Mines.

Eugene A. Smith, State Geologist of Alabama, Dies

Dr. Eugene A. Smith, state geologist of Alabama, died at Tuscaloosa, September 8, at the age of 85. His passing marks the termination of a life devoted to the mineral industry in the State of Alabama. For 55 years on the faculty of the State University, and for 53 years the state geologist, Dr. Smith was a recognized authority on the resources of the state, and the present complete maps and surveys of Alabama are the outgrowth of his foresight and comprehensive planning.

He had also served as vice president and president of the Geological Society of America.

MINING INVESTIGATIONS AT CARNEGIE TECH

FIFTEEN different research studies in mining and metallurgy are being carried on this year at the Carnegie Institute of Technology in cooperation with the United States Bureau of Mines and two advisory boards of mining engineers, metallurgists, steel operators, and chemists, according to an announcement. Thirteen of the problems are being investigated by college graduates appointed as research fellows, one by a research engineer, and another by an analyst.

This year's work, it is announced, is a continuation of the program that has been in effect for several years. Each research fellow is making his studies under the direction of a "senior investigator" representing the Bureau of Mines and a member of the faculty of the Carnegie Institute of Technology. Four of the fellowships are financed this year by Carnegie Tech. Other organizations contributing to the expenses and the fellowship funds are the American Gas Association, New York Edison Company, Philadelphia Storage Battery Company, National Coal Association, International Combustion Engineering Corporation, and 26 companies representing the metallurgical industries. The latter group is financing six of the investigations.

As in former years, it is announced, the results of the studies will be published in bulletin form for distribution at the close of the college year.

The following are among the problems being studied:

Equilibrium between manganese, iron and sulphur; synthesis, testing and application of warning agents for manufactured gas; formation and identification of inclusions; coal ash fusibility as related to clinker formation; methods of determining inclusions; distribution of iron oxide between slag and metal; base exchange in relation to decay and peat formation; safety, costs, and efficiency of distribution of electric power in coal mining; physical chemistry of steel making; relation between composition and oxidizability of coal; viscosity of open-hearth slag; composition of oils and heavy tar from distillation of coal at low temperature; determination of relative ignitibility of low temperature coke compared with coal; study of cause and control of abnormality in case carbonized steel; physical chemistry of steel making (field studies).

New Tipple for Pocahontas

The Pocahontas Fuel Co. has awarded a contract for a new steel tipple and combined washing and dry cleaning plant for all sizes of coal. The nut and pea will be cleaned on hydro-separators, the fine sizes on Arms pneumatic tables. This is the first plant of this combined character ever built.

Jeddo-Highland Enlarges Breaker

The Jeddo-Highland Coal Co. has enlarged its No. 4 breaker, at Jeddo, Pa., to take care of the preparation of coal from its Ebervale and Harley seven slopes, where veins have been almost exhausted, making it unprofitable to operate the Harley breaker.

Heads Hazelton Mining Institute

Effingham P. Humphrey, mining engineer of the Hazel Brook Coal Co., has been chosen president of the Hazelton, Pa., Mining Institute, which will open in October with a number of night classes. A series of monthly meetings at which mine engineers will discuss mining and safety work is planned.

New Pipe Line to Supply Denver With Natural Gas

One of the largest incursions by oil companies into the public utility field was made possible by the passing of an ordinance in Denver recently permitting the Public Service Company of Colorado to supply a natural gas to that city. This will be done by piping natural gas from the Amarillo field in West Texas to Denver. The line will be 365 miles long and will cost between $16,000,000 and $20,000,000.

Why Conserve Coal?

Man should bore holes to get heat from the interior of the earth instead of destroying a highly elaborate substance like coal, the British Association of Science was told by J. L. Hodgson, mechanical engineer.

He declared that heat stored in great spheres inside the earth is at least 30,000,000 times that available in the world's coal reserve. Hot rocks are found, he said, only about 33 miles below the surface and much nearer in volcanic areas.

The speaker said he advocated drilling shafts five miles apart. Workers boring the holes would be protected by heat-proof suits, including liquid air container to supply cool dry air.

He estimated that a cubic mile of hot rock would yield as much heat as burning 200,000,000 tons of coal.

Frank D. Rash, president of the Kentucky Mine Owners Association and also president of the Inland Waterways Co., has been named chairman of a committee of Louisville men to attend the annual meeting, October 4 and 5, at Huntington, W. Va., of the Ohio Valley Improvement Association, which for years has been fighting a battle for deep waterways and increased river traffic. Robert Dugan, of Dugan Coal Co., Louisville, and Clifton Rodes, of Pittsburg Fuel Co., Louisville, are other members of the committee.

Enable Employes to Buy Home Sites

In the interest of their employes, both the Philadelphia & Reading and the Lehigh Coal & Navigation Company, have offered to their workers at Tamaqua, Pa., lots for home sites on easy terms. Each company has about 200 lots available and many of their employes are taking advantage of the offer.

Dr. Walter J. Bryan, formerly assistant state geologist of Alabama, has been appointed state geologist to succeed the late Dr. Eugene Smith. The new appointee is a native of Alabama, and assumes his new office at the age of 32. For three years he has served as assistant to Dr. Smith at the University of Alabama.

For several years Dr. Bryan was engaged in extensive research work for a petroleum corporation in Mexico, and for a while he was instructor in geology at the University of North Carolina.

Frank Haas, prominently identified with the West Virginia coal industry for a number of years as the chief engineer of the Consolidation Coal Company, has resigned, and will take a similar position with the J. H. Weaver & Co. interests of Pennsylvania.

J. G. Bradley, president of the Elk River Coal & Lumber Company, of Dundon, has accepted the invitation of John E. Egerton, president of the National Association of Manufacturers, to represent West Virginia on the Platform of American Industry Committee of One Hundred, which will draw up national plans to be submitted to both the Republican and Democratic Parties at their conventions in 1928.

Colorado Resource Survey

The Colorado natural resource which is the most important to the industrial development of Denver and the Rocky Mountain region is coal, according to a survey of the Pace Co., Chicago industrial development specialists, which has just been submitted to the Denver Chamber of Commerce. The survey, which includes Denver, Colorado, and the Rocky Mountain region, was made under the auspices of the Chamber of Commerce to determine the feasibility of establishing in Denver an organized central manufacturing district similar to those in Chicago, Los Angeles and Longview, Wash., with which the Pace Co. is associated.

Concerning Colorado's coal resources, the report says: "Of all the minerals considered in the survey, coal seems most important as the foundation for industrial development of Denver and the Denver zone. Its relative importance in the state is indicated by the fact that 67 percent of all employes engaged in the mineral industry work in the coal mines, while 55 percent of the total mineral output in dollars and cents is likewise represented by the coal industry. Gold and silver represent 20 percent of all employes and 32 percent of the total output; lead 5 percent of all employes and 5 percent of output; lime 1.4 percent of all employes and 1 percent of output; clay 1 percent of all employes and one-half percent of total output. The analysis of the coal resources of Denver and the advantages to be derived therefrom indicate so positive a favorable factor as alone to provide a foundation for major types of industrial development."

Any connection with I. W. W. strike movements in southern Colorado coal fields was denied by leaders of the United Mine Workers and the State Federation of Labor recently. They branded as false rumors that the United Mine Workers had backed the I. W. W. in its efforts. Citing the I. W. W.'s record since its organization in Chicago, the state secretary of the miner's union declared that in every instance I. W. W. strikes had resulted in breaking down worker's organizations and have resulted in lowered wages and working conditions.

Tackle Salt Lake's Smoke Problem

At a meeting in the Chamber of Commerce-Commercial Club, at Salt Lake City, September 7, between the anti-smoke committee of the Chamber Club and coal mining operators, called at the request of the former, the city's smoke problem during the winter months was discussed. The coal men were urged to do all they could to furnish smokeless fuel for the city. L. F. Rains, president of the Carbon Fuel Co., and president of the Utah Coal Operators' Association, said that while a smokeless fuel is not available for the city now, tests are being made right along and everything points to the perfection of a low-temperature carbonization fuel that can be burned with a minimum amount of smoke. Mr. Rains urged the organization of the retail coal men of Salt Lake City, saying that they would be in a position to distribute information regarding the proper firing of heating plants as well as the best kinds of coal to use. "Coke is available and is an ideal fuel," said Mr. Rains, "but there are few people who will buy it."

WILL ROGERS ON THE COAL SITUATION

AT the request of a friend of former Gov. John J. Cornell, of West Virginia, Will Rogers, the internationally known humorist, recently sent a letter to the Governor, who was at the time seriously ill in a Los Angeles hospital. The following excerpt is proof that the actor-author-humorist, etc., knows more about the coal situation than most folks:

"I got a friend in Huntington, if that is where you come from. He is not in the hospital, but he is in the coal business, and that was just about as bad the last time I was there."

Iowa Operator Signs Up

Employes of the Knox mine, south of Knoxville, Iowa, returned to work early in September after A. A. Knox, operator, came to an agreement with officials of the United Mine Workers to operate under the Jacksonville agreement.

The workmen at this mine had organized and joined the local union at Pershing. Immediately afterward Knox closed the mine, which had been operated on a non-union basis for several years.

Davis & Fleener, who operate a mine near Marysville, completed negotiations to run under the Jacksonville agreement and union officials launched a campaign to organize every mine in Marion County.

The Susquehanna Collieries Co. has filed an appeal to the Luzerne County courts from valuation of its coal property in Nanticoke, alleging discrimination. The appeal affects a valuation of $2,500,000.

Prepare Evidence in Support of Reduced Lake Coal Rates From Southern Fields

Counsel for railroads and coal operators of the Southern fields met in Washington, September 14, in private conference to prepare evidence in support of the schedules filed early in August by Southern carriers proposing a reduction of 20 cents a ton on lake cargo coal. The rates in question, which are now under suspension and investigation by the Interstate Commerce Commission, were proposed following the recent decision of the commission in the famous lake cargo coal case which made a reduction in the rates from northern fields. Hearings are expected to be held sometime in October.

Coal Rates From Kentucky and Illinois to St. Louis

Oral arguments in the several cases involving rates on coal from Illinois and western Kentucky mines to St. Louis and East St. Louis will be heard by the Interstate Commerce Commission, October 13, in Washington, D. C. The examiner who heard the cases has recommended a reduction in the rates to St. Louis of 3 cents a ton and the publication of rates to East St. Louis on a basis of 30 cents a ton under the proposed St. Louis rate. W. Y. Wildman and R. W. Robiquet will represent the Illinois Coal Traffic Bureau at the Washington hearing.

Industrial Bodies Join the A. E. S. C.

The Portland Cement Association and the American Gear Manufacturers Association have become members of the American Engineering Standards Committee, with direct representation on the Main and Executive Committees.

The Cast Iron Pipe Research Association is another organized industrial group which has taken definite steps toward becoming a member of the A. E. S. C.

There are now 26 member bodies, including in all 18 trade associations, 9 technical societies, and 7 departments of Federal Government. There are 60 members on the Main Committee.

United States Generates 40 Percent of World's Electricity

In the generation of electrical power, the United States has accomplished more than any other country and has not a close competitor, although there might be other countries with potential electrical power approximating that of the United States, according to the Department of Commerce.

It is estimated that approximately 40 percent of the world's electrical power is generated in the United States.

SOAP BUBBLES USED TO STUDY GASEOUS EXPLOSIONS

A SOAP film has often rendered notable service to science, and that in quite diversified fields. A new and important application of it has recently been made at the National Bureau of Standards where, in the form of a common soap bubble filled with the charge of explosive gases to be investigated and fired by a spark from the center, it permits, on account of its extreme delicacy and transparency, a continuous photographic record to be made of the progress of the explosive reaction from the instant the ignition spark passes to the instant the reaction is completed.

The remarkable photographic records so secured show that instead of being a haphazard, wholly erratic process as one is led to infer from the mere testimony of eyes and ears and the broken fragments of strong containers, the explosive reaction, under the condition of constant pressure which the bubble provides, is seen to be as law-abiding and accurately symmetrical as any known. The photographic records secured by the bubble device gave all the quantitative dimensions necessary for the determination of the thermodynamic equilibrium; for the degree of dissociation of the combustion products; and, in case an inert gas is present in known quantity, for the specific heat of that gas at the high temperature of the explosion. All of the relationships involved in the determination of these magnitudes are indispensable to a better understanding of the gas engine. The bubble device is a wonderfully perfect engine in itself. It operates without bearings, cylinder, or piston, and with small heat losses against the pressure of its surroundings. The photographic record is an accurate engine diagram of the mechanical work executed by the known charge that has exploded.

But it is in another line equally as important as the thermodynamic, that the bubble device has given new quantitative knowledge. It has revealed the first insight yet won concerning the kinetics (rates), of gaseous explosions, in terms of the composition of those gases. It has shown that the linear rate at which the zone of reaction, the flame, liberates the energy of the explosive gases in which it is propagated, is proportional to the product of the concentrations of the active gases the flame is entering.

Canada Sees Good From Mining Congress

The recent British Mining and Metallurgical Congress in Canada is regarded as an event of outstanding importance by the Canadian Pacific Railway. The railway, in a bulletin, notes that the congress brought to the Dominion experts of high standing in all branches of their profession from all parts of the British Empire, to deliberate and exchange views on mining matters as they affect the empire as a whole. Delegates toured the country from coast to coast, visiting many established and developed mining fields and gaining at first hand a good knowledge of Canada's mineral wealth, actual and potential.

"The ultimate value to Canada," the writer continues, "of the impression the country's possibility must have made upon such men who frequently have the disposition of huge sums for investment through the channels of mining exploitation can scarcely be overestimated. The decision to hold what is only the second congress of this important body in Canada was in itself a tribute to the Dominion's standing in mining in the empire and the world."

Budget Bureau Considers Mining Research Needs

Consideration is being given by officials of the Budget Bureau to requests of the various Government departments for appropriations for the year beginning July 1, 1928. Director George Otis Smith of the Geological Survey was among officials who were before the Budget Bureau recently, explaining the financial needs of their departments for the new year. While no official comment was made, it is known that officials of the Bureau of Mines and Geological Survey were pleased over the resolution adopted at Salt Lake by the Western Division of the American Mining Congress in favor of more liberal appropriations for the important work of those bureaus. The Budget Bureau will send the estimates of appropriations to Congress at the December session.

Standards for Electric Welding Apparatus

Standards for electric arc and resistance welding apparatus have been submitted to the American Engineering Standards Committee as a basis for national standards on these subjects by the American Institute of Electrical Engineers.

As an example of the rapid growth of electric-resistance welding, a single plant may be cited in which more than 200 different automotive parts now undergo welding at some point in their production cycle. More than 1,000 men are there engaged in spot and butt welding alone, and nearly three and a half million spot welds are made every day on the different parts. Spot-welding machines have been made practically automatic.

The standards submitted as a base of national uniformity include nomenclature, methods of making dielectric tests, and methods of rating, to be used as a basis of guarantee for the following types of apparatus used in electric and resistance welding operations: Direct-current generators, motor-generator sets, transformers, resistors, and apparatus for electro-percussion welding. Butt, flash, pressure-contact, spot, and seam welding are differentiated.

The proposal of the institute, which is of importance to several organized industrial groups, including the Association of American Steel Manufacturers and the American Welding Society, has been referred to the Electrical Advisory Committee for study and recommendation to the A. E. S. C.

"Utilization of Blast Furnace Slag in Highway Improvement" is the title of a bulletin issued by the Missouri School of Mines, Rolla, Mo. Clarence E. Bardsley, Sc.D., associate professor of civil engineering, is the author. The bulletin contains 115 pages and 17 illustrations; 8 tables, 39 pages of descriptive matter and a bibliography of 600 references.

Its chapters include a resume of the history, manufacture and use of slag as a structural material; tests on blast furnace slag, their interpretations and conclusions; and conclusions from the tests mentioned and the general study made, and recommendations are given for further study where little information was available.

Copies of this paper may be obtained on application to the Librarian of the Missouri School of Mines, or to the author. Address requests on letterheads.

After an idleness of several months following an explosion which wrecked a large part of the mine and took the lives of several men, the Woodward colliery of the Glen Alden Coal Company, near Wilkes-Barre, Pa., has resumed operations. Nearly 1,000 men returned to work.

METHODS OF REFINING SHALE OIL BEING STUDIED, FOLLOWING CLOSING OF EXPERIMENTAL PLANT

FOLLOWING the recent closing down of the Experimental Oil Shale Plant of the United States Bureau of Mines, near Rulison, Colo., studies of the best methods of refining shale oil are being made at a number of institutions. Two 6,000-gallon tank cars of shale oil produced at the plant have been shipped to the League Island testing plant of the Navy Department, where tests will be made to determine the suitability of raw shale oil as fuel for naval vessels. This represents the first tank-car lot shipment of shale oil made on the North American continent. Approximately 150 barrels of the oil produced were sent to the Boulder, Colo., laboratory of the Bureau of Mines, where studies are being made in a $10,000 experimental refinery erected by the State of Colorado. A total of about 100 barrels of shale oil has been shipped to a number of oil refineries and laboratories, where studies will be made to determine the best methods for refining this oil. The results of these investigations will be made known to the bureau. The experimental plant was shut down on June 30, due to the failure of the second deficiency bill in Congress, which contained an item of $70,000 for continued operation of the plant.

The experimental oil shale plant was built as the result of the recommendation of the President's Naval Oil Reserve Committee that information be obtained as to the value of the naval oil shale reserves as future sources of oil for the Navy, especially in time of national emergency.

An appropriation of $90,000 for this work became available on March 3, 1925, and an additional appropriation of $89,000 became available on July 1, 1926, to take care of plant operations during the fiscal year ended June 30, 1927. As soon as the first appropriation was made, a site was selected for the retorting plant on Naval Oil Shale Reserve No. 3. A site for the mine was selected on Naval Oil Shale Reserve No. 1, adjoining Reserve No. 3.

Shortly after the original appropriation became available, M. J. Gavin, engineer in charge of the oil shale work of the bureau, was sent to Scotland and France, where he made a study of the methods that have been followed in extracting oil from shale for a long period. While in Scotland, Mr. Gavin purchased a Pumpherston retort, the type of retort that has been used in Scotland and which is the result of over 70 years practical experience in oil-shale retorting. This retort was shipped to the United States and erected at the plant site under the supervision of an expert construction man who was brought from Scotland for that purpose. The work of erecting this retort and auxiliary equipment was started in November, 1925, and completed in the spring of 1926. Another retort, the N-T-U, using quite different principles and of American design, was also purchased out of the original appropriation of $90,000 and the work of setting it up on the plant site was completed in December, 1926. The two retorts form a good combination for experimental studies in that the Pumpherston retort exemplifies slow distillation and the N-T-U retort rapid distillation. In addition to the two retorts and auxiliary equipment, the experimental plant consists of a water-supply system which pumps water from the Colorado River, about one and one-half miles from the plant, two 35 hp. boilers, a 40 hp. gas producer, a 5 k. w. turbo-generator for plant lighting and laboratory power, two 250-barrel storage tanks, six 25-barrel receiving tanks, a small pipe still for recovering scrubber naphtha, machine shop, control laboratory, temporary office building, and temporary quarters for plant employes. A 5,600-ft. aerial tramway was constructed for transporting the shale from the mine to the retorting plant. Other equipment includes a crusher, gasoline engines, mine cars, mine scales, air compressor, rock drills, etc.

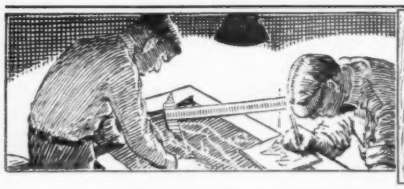
After preliminary heating extending over a period of about three months to thoroughly dry the retort and settings, the first run on the Pumpherston retort was started on September 17, 1926. This retort was operated continuously from that date until midnight of June 30, 1927, with the exception of a few weeks during the months of November and December, when difficulties were encountered in keeping the tramway in operation, and for brief periods of a few hours each during the remainder of the time when it became necessary to shut down the retort due to difficulties encountered in handling coking shale. The first run on the N-T-U retort was made on January 17, 1927, and it was operated intermittently until June 1, 1927. Considerable difficulty was encountered in keeping the retorting plant in operation during the winter months of 1926-27 due to the fact that the worst weather that has occurred on the western slope of Colorado for the past several years was experienced. Because of the numerous blizzards and extremely cold weather, it was impossible to bring down sufficient shale from the mine to keep both retorts in continuous operation.

During the time that the plant was operating, a total of 2,009 tons of oil-shale was run through the retorts, yielding a total of 891 barrels of oil. This is equivalent to an average yield of 18.6 gallons per ton. The shale charged to the retort had an oil content of from practically nothing to some material containing as high as 75 gallons per ton on assay tests, although the highest average yield for a single day's operation was 42 gallons per ton. The oil shale used came from a quarry at the outcrop of the shale on the escarpment about 2,700 feet above the plant. A thickness of approximately 60 ft. of the shale escarpment was mined, which included the rich "mahogany ledge."

The oil produced by the Scotch retort had an average gravity of about 28 degrees A. P. I. and yielded an average of about 25 percent gasoline and naphtha. The oil from the other retort had an average gravity of about 21 degrees A. P. I. and had a gasoline-naphtha content of about 8 percent. The gasoline-naphtha fraction from both crudes was deficient in low boiling fractions, and it would be necessary to blend the product with more volatile material in order to produce a finished motor fuel. Experiments demonstrated that additional quantities of gasoline could be made from shale oil by cracking. Due to the high content of unsaturated hydrocarbons and nitrogen compounds, the distillates from shale oil are difficult to treat in order to produce commercial products. The work on refining shale oil is being continued at the Boulder laboratory in cooperation with the State of Colorado.

As a result of the two years work in building and operating the experimental plant, the Bureau of Mines has obtained valuable information on such questions as drilling and shooting oil shale, the effect of retorting conditions on the yield and quality of oil, the methods to be employed in refining shale oil, etc.

It was not expected that mining and retorting cost figures could be obtained by continuing operations for so limited a period on such a small scale, but it is thought that the tests demonstrate the value of the naval oil shale reserves as potential sources of naval oil fuel supplies. The retorting studies will point out the principles to be followed in designing retorts for handling Colorado oil shales. An exhaustive report, covering the results of this experimental work, is now in course of preparation. The plant will remain closed until authority is granted by Congress either to permanently abandon the plant, arrange to have it operated by outside interests, or to have operations resumed by the Bureau of Mines.



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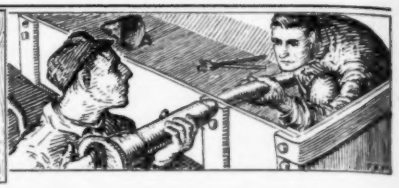


American Rheolaveur to Manufacture Centrifugal Drier

The American Rheolaveur Co. has recently completed an arrangement with H. B. Carpenter of Fueblo, Colo., to design, manufacture and sell the Carpenter centrifugal drier, which was patented by him and which is used at the Minnequa Works of the Colorado Fuel & Iron Co.

According to information from people using driers, there is a great need for a mechanical drier for drying coal and that it seems the Carpenter drier more nearly fills this want than any driers, which have yet been introduced on the market, as it will efficiently dry coal down to 5 or 6 percent moisture at a low cost per ton for power and labor, maintenance and repair.

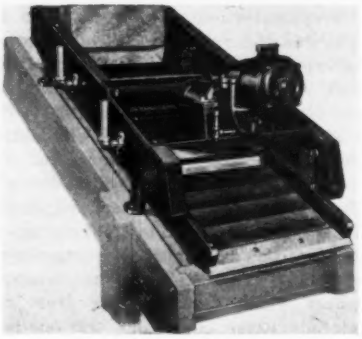
They are building a new drier at the present time and when this has been tested, information will be available as to results obtained.

Du Pont Develops Powder Bag

At the suggestion of and in cooperation with several leading mine operators, the du Pont Co. has developed a powder bag for the economical, safe and practical carrying of high explosives from storage to the working face.

The material used in making the bags is a specially treated fabric which is waterproof and resistant to fungus, dry rot, acid waters, vitiated air, and all similar underground conditions. It is also a non-conductor of electricity. Experience has shown the risk run by the use of untreated canvas bags and the ever-present danger of the tearing or coming apart of bags when explosives are being carried up raises or otherwise handled in mines, quarries and construction work. The material used in making du Pont powder bags is the same as that from which du Pont Ventube is made. Two types—pouch and knapsack—are made and the capacity of the bags varies from 50 to 125 sticks of dynamite.

The Erie Railroad has ordered two oil-electric locomotives for yard-switching service in the city of Akron, Ohio. These two units are of the 100-ton type. The locomotives are a joint product of the General Electric Co., the American Locomotive Co., and the Ingersoll-Rand Company.



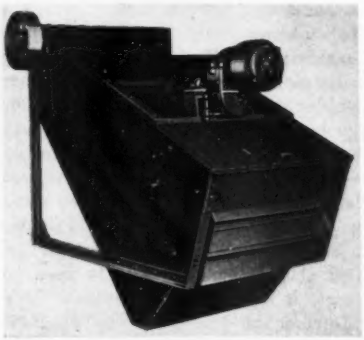
James Wet Screen

The James Screen to be Manufactured By Norwood Engineering Co.

The Norwood Engineering Co., Florence, Mass., has acquired the United States, Canadian and Mexican manufacturing and selling rights on the James Screen, a recently developed vibrating screen with some exceptional and interesting features.

The James Screen was developed by U. S. James, mechanical and metallurgical engineer of Newark, N. J., and is based on what is claimed to be a new principle of vibration. Its manufacturers claim it has proven itself in many ways a superior screen through its ability to handle tremendous loads of any screenable material, either wet or dry, and do an accurate, efficient and economical job of screening and sizing.

Mr. James, who is well known in the mining field for his many developments in concentrating machinery, both in this country and abroad, originally designed and developed the James Screen for the sizing of ores. A new principle of vibration was necessary in order to give higher capacity and absolute freedom from blinding, sectional screens were developed to reduce the expense of replacement of an entire screen when worn in part only and washing trays were designed to disintegrate the accumulation of mud balls on wet screening.



James Dry Screen

The success of the James Screen in meeting the exacting screening and sizing requirements of metal mining have naturally brought a big demand for the screen in other industries, and it has found ready application in many different fields.

One of the outstanding features is the vibrating mechanism. The present vibrator consists of only three moving parts: a gyrating ram weighing over 30 pounds operates against a heavy piston, which in turn transmits the shock through a small anvil to a wooden cross member connecting the hanger bars which carry the screen frame. This ram gyrates at 300 revolutions per minute and each of its six chilled steel sockets collide with the hardened steel contact points of the piston, giving to this latter member 1,800 head-on collisions per minute. These repeated shocks transmitted to the screen in this manner keep the screen from blinding and give uniformity vibration over its entire surface.

The vibrator is housed in a heavy dust, dirt and water-proof cast iron casing and requires a change of oil but once in every three or four months. The screen frame is suspended by flexible vanadium steel hangers so that neither dust, grit nor moisture can possibly affect the free movement of the screens.

The screen frames are built in sections, which are interchangeable, every six square feet of screening surface may be removed and replaced under actual working conditions in less than two minutes.

When screening materials by the wet process, finer than 3/16-in. in diameter, auxiliary washing trays located every two feet across the screen area, serve to disintegrate the accumulation of mud balls and by the addition of a sufficient amount of wash water, the fine grains are forced through the meshes with great rapidity.

The James Screen operates with a one horsepower motor, or from line shaft. Screens up to 18 ft. in length have been

built and are operating satisfactorily with the same size motor, there being the same uniformity of vibration over the screening surface of a large screen as over a small one.

The Norwood Engineering Co. builds both the James Wet and the James Dry Screens and special screens are designed where necessary to meet special requirements.

The Norwood Co. has been established for over 40 years and has built up an international reputation for high quality and dependability. They are pioneers in many fields of mechanical development, their organization is composed of progressive engineers, and they have the plant and facilities for efficiently manufacturing the James Screens.

The sales office of the screen department of the Norwood Engineering Co., is at 200 Dartmouth St., Boston, Mass.

Plans are under way to establish at Florence, Mass., or in Boston a laboratory equipped with both the James Wet and Dry Screens with different wire or cloth screen sections for testing and making screen analysis. This work at present is done by the James Ore Concentrator Co., at their laboratories in Newark, N. J.

Do the Sheaves Fit the Rope?

There is perhaps no single element that can be more detrimental to wire rope than an improperly fitted sheave, according to Walter Voigtlander, Rope Engineer of the American Cable Co. A pinching sheave, for instance, will do more damage to a wire rope in one hour than a properly grooved sheave could in an entire week or more. Or a sheave with too soft a tread will increase abrasion and grinding action to an extent that will cause premature breaking of the outer wires and loss of rope strength. Because of these facts and because sheaves are cheaper than good wire rope, it may be well to look to the sheave and auxiliary equipment if it is felt that the life and service being received from present rope is not all that it should be.

Engineers and operators some times overlook the fact that by the time it becomes necessary to install a new rope the old sheave will have become worn to such an extent that it will cause serious loss to the service of the new rope. Invariably excessive wear to the outer wires can be traced to the abrasive action of worn or too soft sheave treads.

When installing a new rope, Mr. Voightlander says, it is economy to gauge both the rope and the grooves of all sheaves and drums. If the groove diameter of any sheave is less than the actual callipered rope diameter, decreased service is bound to result.

One of the simplest and most accurate methods for gauging sheave treads is through the use of a groove gauge. If this device is used with care, and if the tolerances given in the accompanying table (which have been worked out in accordance with long experience) are strictly adhered to, there may be reason to expect longer and more satisfactory rope service.

At the time such attention is given sheaves it is well, also, to check up on alignment. Alignment will cause considerable wear to both rope and sheaves. Particularly in high-speed work is it necessary to maintain proper alignment of all equipment and to balance all sheaves.

Heavy Duty Speed Reducer

The James Heavy Duty Worm Gear Speed Reducer has recently been marketed by the J. O. James Manufacturing Co.

Worms and gears are run in on a special relieving machine to assure the smooth, frictionless action of the worm and gear.

A large oil cooling chamber prevents over-heating. When the worm is at the top of unit, sight feed oil cups are used for furnishing a high grade of oil to the roller bearings on the worm shafts. The oil level cock, fitted into the side of the housing, prevents over-oiling—a condition as serious as under-oiling. An oil drain plug in the lower part of the housing facilitates cleaning and draining of gear oil.

In this advance type of heavy duty worm gear speed reducer phosphor bronze gears, S. A. E. 3140 chrome nickel steel worms, Timken and Norma Hoffman Roller Bearings and interchangeable bushings are used to provide the utmost in satisfactory service and long life.

Dorr Co. Exhibit at Chemical Exposition

The Dorr Co.'s exhibit at the Eleventh Exposition of the Chemical Industries, at the Grand Central Palace, New York, September 26 to October 1, consisted of small units of Dorr equipment in operation, handling representative chemical products, together with photographs of installations at chemical plants.

The new Dorrco Filter was introduced to the chemical industry as a feature of the exhibit, and the principle of operation illustrated by a small unit dewatering a segregating pulp made up of a mixture of fine and coarse material. This filter is of the vacuum drum type although different in many respects from other filters of this type. One of the most striking features of its construction is the applying of the filter medium on the inside of the drum, this drum being open at one end and provided with an internal flange to retain the pulp during filtration. This construction not only eliminates the filter tank, but also takes advantage of the tendency of the solid particles to segregate by gravity against the filter medium instead of away from it.

One large Dorrco Filter has been in commercial operation for over a year and other units have been operating for some months. While the ability of this filter to handle coarse material is one of its most interesting features this unit is equally well adapted to handling the other pulps which are generally dewatered on vacuum filters.

Other equipment included:

A six foot diameter Dorr traction thickener and Dorrco suction pump dewatering a dilute chemical pulp and clarifying the solution in which the solids are suspended.

The Dorr Traction Clarifier, an application of the traction thickener principle for use in square settling tanks, shown as a 5-ft. square working model, and smaller models of the Dorr tray thickener, Dorr agitator and Dorr bowl clarifier.

Westinghouse Opens New Chilean Branch

The Westinghouse Electric International Co. has just announced the establishing of a new branch to be known as the Compania Electrica Westinghouse de Chile, with activities in the countries of Chile and Bolivia. Mr. E. L. McCloskey, formerly manager for China of the Westinghouse Electric International Co., has been appointed manager of the new branch with headquarters at Santiago, Chile.

Mine Safety Appliances Personnel Changes

The Mine Safety Appliances Co., Pittsburgh, Pa., announces the following appointments and changes in sales personnel: The appointment of M. B. Orfald as district representative at Duluth, Minn., with headquarters at 1928 E. Superior St., and John B. Jones as district representative at Fairmont, W. Va., with headquarters at 624 Fairmont Ave. George L. Seth, former district representative at Buffalo, N. Y., has been transferred to Pittsburgh as assistant sales manager. Mr. Seth has been succeeded at Buffalo by C. M. Donahue, 292 W. North St.

Luther H. Bosnian has been appointed superintendent of the Park Street Plant of the Chain Belt Co., Milwaukee., manufacturers of REX Conveyors, Travelling

Water Screens, Chain and Concrete Mixers. Mr. Bosnian has been connected with the Chain Belt Co.'s production department for the past eight years.

Westinghouse Officials Promoted

Promotion by which R. L. Wilson, works manager of the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Co., becomes assistant to vice-president and general manager, and J. M. Hipple, manager of the company's Motor Engineering Department, is elevated to the position of works manager, have been announced by F. A. Merrick, vice-president and general manager.

Mr. Wilson has been an active worker in the electrical industry since 1893 when he joined the Westinghouse Co.

Mr. Hipple entered the employ of the Westinghouse Co. in 1898. From 1900 to 1911, he worked on direct current motor design and in 1911 was made manager of the Motor Engineering Department, in which capacity he had charge of the designing for all industrial apparatus.

General Electric Catalogs

Among the pamphlets recently issued by the General Electric Co., Schenectady, N. Y., descriptive of some of their products, are the following:

Air Compressor Governors, G-E Squirrel-Cage Motor (220 to 2200 volts), Adjustable Varying Speed Motors (110 and 221 volts), G-E General Purpose Synchronous Motors (220 to 2200 volts), Motor Starting Switches for small induction motors, Vertical Induction Motors (220 to 2200 volts), Totally Enclosed Induction Motors (220 to 2200 volts), A-C Jack Type Disconnecting Switches, Metal-Melting Pots and Equipment for Metal-Melting Pots, G-E Air Heating Units.

International Nickel Bulletins

The following publications, issued by the International Nickel Co., 67 Wall Street, New York, constitute the third and fourth of a series of semi-technical bulletins of interest to consumers of nickel:

"The Economic Value of Nickel in Cast Iron." A resume of the general characteristics of commonly used nickel-bearing cast iron compositions with a number of typical mixtures and a discussion of the saving effected and the difficulties overcome by their substitution for ordinary cast iron.—Bulletin No. 203 (12 pages).

"Effect of Nickel on Machinability of Cast Iron." A non-technical explanation of the function of nickel in eliminating chilled edges from light castings and hard skin from heavier ones without impairing the physical properties as is the case when the common elements of cast iron are employed for this purpose.—Bulletin No. 204 (4 pages).

Keystone Drill Catalogs

Two new catalogs have just been issued by the Keystone Driller Co., Beaver Falls, Pa. The first is their General Drill Catalog, a book of 106 pages, describing the complete line of Keystone well drills for all purposes—water well drilling, blast hole boring, mineral prospecting, placer gold testing and oil and gas well drilling. In this book a number of new models of the portable oil drill are described, new applications of gas power, new methods of transportation and new features of well drilling equipment. It is expected that well drillers, engineers, contractors and quarrymen will find this publication to be of considerable interest and general value.

The second publication is Keystone Blast Hole Drills, a 60-page catalog of specialized portable well drills, traction and non-traction, for use in drilling blast holes in cement and limestone quarries and in heavy excavation. The book contains also a discussion of the best methods of spacing holes, loading and shooting. Quarrymen, contractors and engineers will find this 60 page book of interest for their files and technical libraries.

An historical introduction appears at the beginning of each book.

In the near future the Keystone Driller Co., expects to issue a new edition of their 112-page Well Drillers' Manual, in which there will be a very elaborate chapter, of an historical nature, describing the evolution of the cable well drill. It will be fully illustrated with a number of interesting drawings and cuts from various sources.

Bulletin No. 1028 of the American Blower Company, Detroit, Mich., is devoted to "Collecting Fly-Ash and Coal Dust," with descriptions of their "Sirocco" dust collector.

Bulletin 900 of the Electric Controller & Mfg. Co., Cleveland, Ohio, describes in detail the new EC&M type SA lifting magnet. Copies will be furnished upon request.

The Traylor Engineering & Mfg. Co., Allentown, Pa., have issued a 40-page bulletin, No. 2106, devoted to the "Heavy Duty Crushing Rolls," which they manufacture. Bulletin 2106, which is well illustrated, supersedes No. 1106.

The Crandall Packing Company, Palmyra, N. Y., have issued a new catalog covering the various kinds of packing which they manufacture, including ring, coil, and sheet for general and special steam and hydraulic service.

The Dorr Company, New York City, has appointed A. Anable, for several years connected with its equipment sales department, as director of publicity for the company.

Law Requires Registration of Mineral Producers

Registration of every producer and manufacturer of mineral products in North Carolina with the Department of Conservation and Development is required in a law enacted by the recent General Assembly.

The law also requires that individuals or firms starting in the production or manufacture of materials classed as minerals shall notify the department of their intention to begin such a business, and that those discontinuing shall apprise the department of this fact.

State Geologist H. J. Bryson announces that the law is designed to aid in the compilation of statistics relating to minerals and to aid in the development of the resources of the state.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

OF THE MINING CONGRESS JOURNAL, published monthly at Washington, D. C., for October 1, 1927.

City of Washington,
District of Columbia, ss:

Before me, a notary public in and for the state and county aforesaid, personally appeared R. S. Mowatt, who, having been duly sworn according to law, deposes and says that she is the assistant business manager of the MINING CONGRESS JOURNAL, and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 411, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, and business managers are:

Name of publisher, The American Mining Congress; post-office address, Washington, D. C.

Editor, E. R. Coombes.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 percent or more of the total amount of stock): The American Mining Congress—a corporation, not for profit. No stockholders. Wm. H. Lindsey, president, Nashville, Tenn. Robert E. Tally, first vice-president, Clarkdale, Ariz. George B. Harrington, second vice-president, Chicago, Ill. H. W. Seaman, third vice-president, Chicago, Ill. J. F. Callbreath, secretary, 841 Munsey Bldg., Washington, D. C.

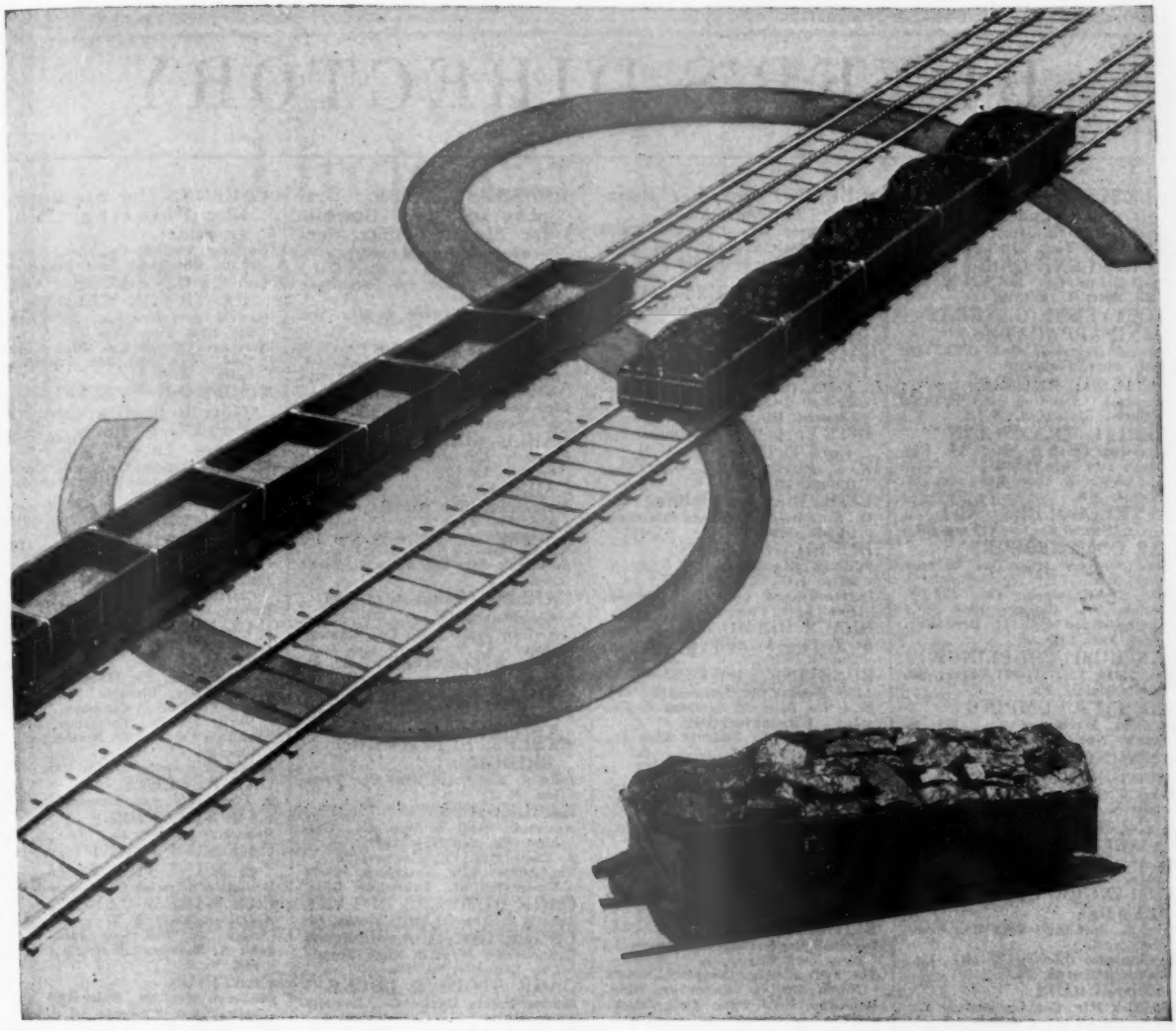
3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state): None.

R. S. MOWATT,
Assistant Business Manager.

Sworn to and subscribed before me this 29th day of September, 1927.

[SEAL] THOMAS C. WILLS.

(My commission expires January 4, 1932.)



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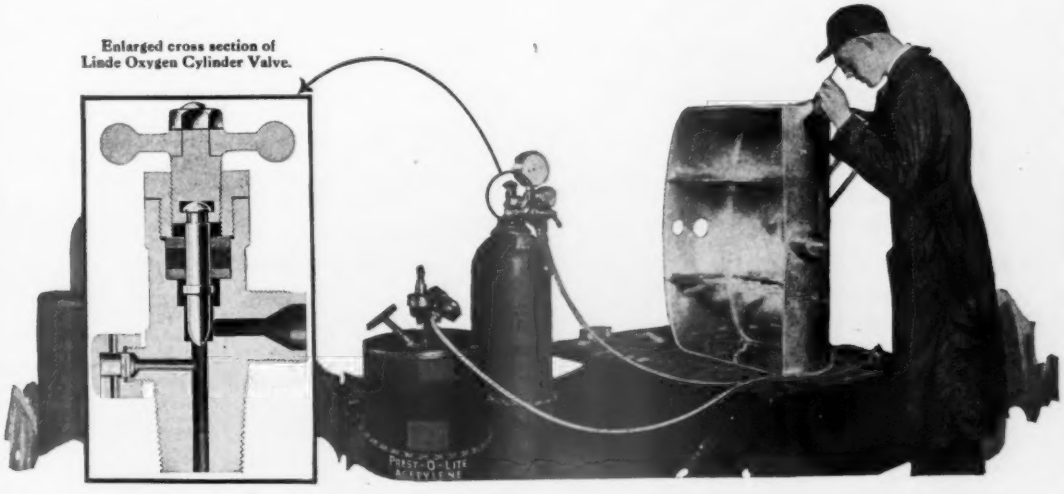

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Keystone Lubricating Co., Philadelphia, Pa.

CUTTING APPARATUS, Oxy-Acetylene, Oxy-Hydrogen
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DECARBONIZING APPARATUS
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H. R. Ameling Prospecting Co., Rolla, Mo.
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R. S. Patrick, Sellwood Building, Duluth. Minn.

DIAMONDS, BLACK (See Carbon and Bortz)
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DIAMONDS, INDUSTRIAL
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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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DRILLS, PROSPECTING
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Hoffman Bros., Punxsutawney, Pa.
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Keystone Churn Drill Co., Beaver Falls, Pa.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Ingersoll-Rand Co., 11 Broadway, New York City.

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du Pond Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., 934 King St., Wilmington, Del.

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GAS (Nitrogen, Oxygen)
Linde Air Products Co., 30 E. 42nd St., New York City.

GAUGES, WELDING
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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

GEARS, HERRINGBONE
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GEARS, Machine Cut
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Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
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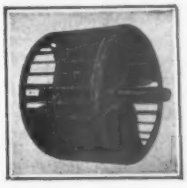

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Knox Mfg. Co., 811-821 Cherry St., Philadelphia, Pa.

HOSE NIPPLES
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Ohio Brass Co., Mansfield, Ohio.

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Vulcan Iron Works, Wilkes-Barre, Pa.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES, RACK RAIL
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

LOCOMOTIVES, STEAM
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES, STORAGE BATTERY
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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
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LOCOMOTIVES, TROLLEY
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Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LONGWALL MACHINES
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

LUBRICANTS
Keystone Lubricating Co., Philadelphia, Pa.

LUBRICATORS
Kekstone Lubricating Co., Philadelphia, Pa.

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Morse Chain Co., Ithaca, N. Y.

MANIFOLDS, OXYGEN
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

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John A. Roebling's Sons Co., Trenton, N. J.

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Knox Mfg. Co., Philadelphia, Pa.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MILLS, STAMP
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

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American Steel & Wire Co., Chicago, Ill., and New York.
John A. Roebling's Sons Co., Trenton, N. J.

MINE SIGNALS
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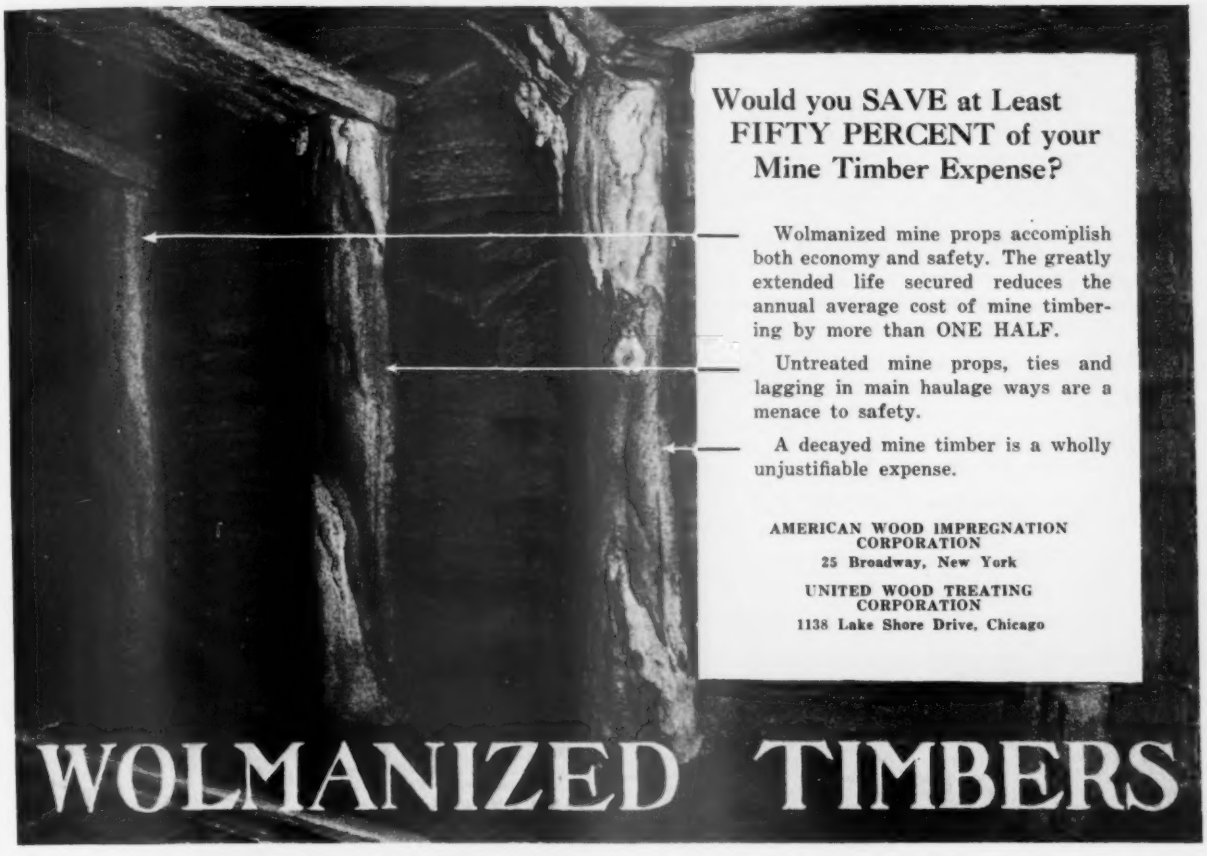
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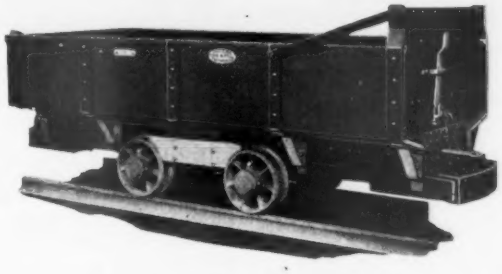

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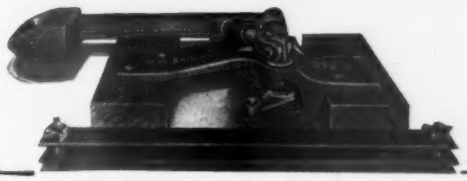

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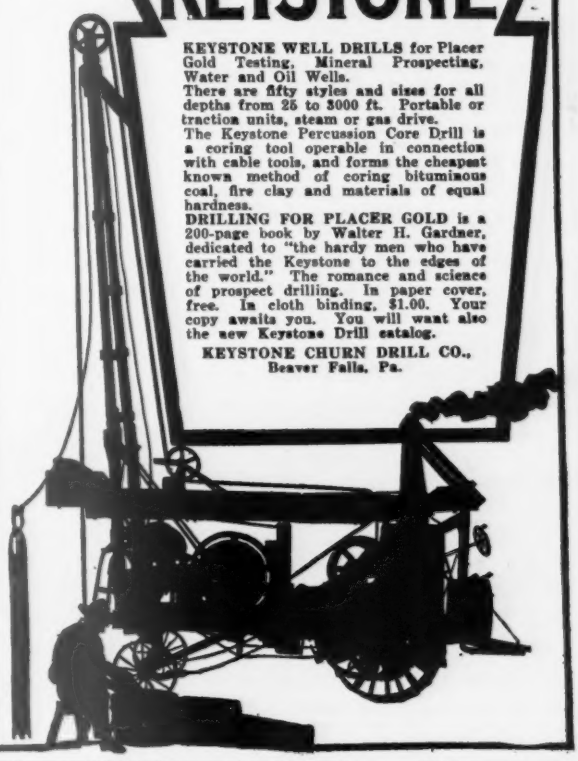

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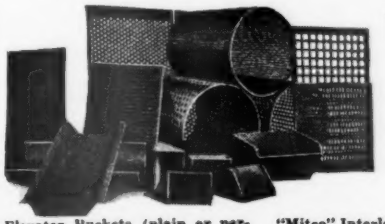

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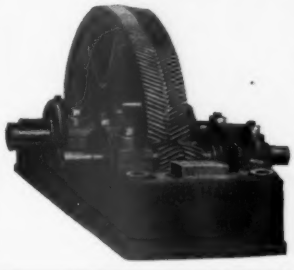

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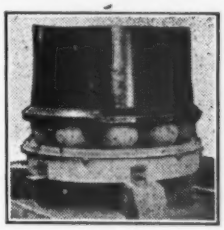

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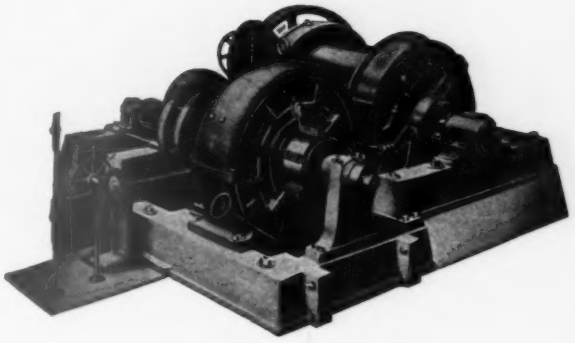

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INDEX TO ADVERTISERS

	Page
Allis-Chalmers Mfg. Co	35
Ameling Prospecting Co., H. R	41
American Car & Foundry Co	29
American Coal Cleaning Corp	Inside Back Cover
American Lumber & Treating Corp	26
American Steel & Wire Co	26
Byers Co., A. M	28
Cameron Steam Pump Works, A. S. (Ingersoll-Rand Co.)	21
Carnegie Steel Company	16
Central Frog & Switch Co., The	37
Coloder Co., The	12, 13
Connellsville Mfg. & Mine Supply Co	43
Copper & Brass Research Assn	22
Delamater, G. R	43
Diamond Machine Co	41
Ellis Mill Co	43
Enterprise Wheel & Car Corp	24
Fawcus Machine Co	43
Flory Mfg. Co., S	50
Goodman Mfg. Co	17
Hendrick Mfg. Co	43
Hercules Powder Co	5, 10, 11
Hoffman Bros.	41
Hyatt Roller Bearing Co	33
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works)	21
Irvington Smelting & Ref. Works	39
Jeffrey Mfg. Co	6, 7, 8, 9
Keystone Churn Drill Company	41
Keystone Lubricating Co	43
Knox Mfg. Co	Inside Front Cover
Lehigh Coal & Navigation Co	45
Linde Air Products Co., The	31
Link Belt Company	51, 52, 53, 54
Mining Safety Device Co	39
Morse Chain Co	Back Cover
National Carbon Co	18
Ohio Brass Co	41
Patrick, R. S	39
Pennsylvania Drilling Co	41
Phelps Dodge Corp	39
Phillips Mine & Mill Supply Co	37
Punxsutawney Drilling & Contracting Co	41
Roberts & Schaefer Co	3
Robinson Ventilating Co	35
Roebling's Sons Co., John A	23
Standard Oil Co	27
Stonehouse Signs, Inc	39
Sweets Steel Co	43
Symons Brothers Co	14, 15
Thompson, W	39
Timken Roller Bearing Co	19
Thorne Neale & Co., Inc	45
Union Carbide Sales Co	20
United Wood Treating Corp	37
Westinghouse Electric & Mfg. Co	25
West Virginia Rail Co	39

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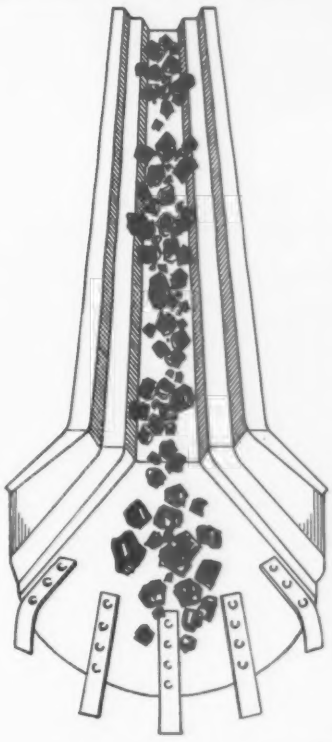

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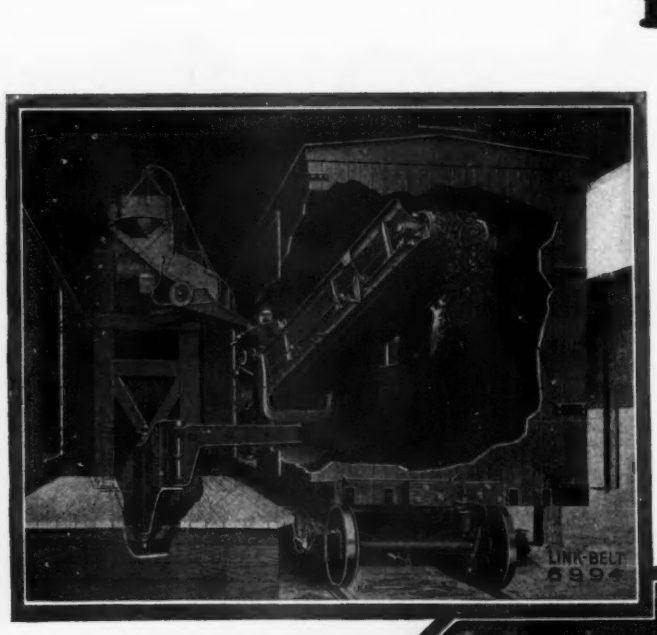

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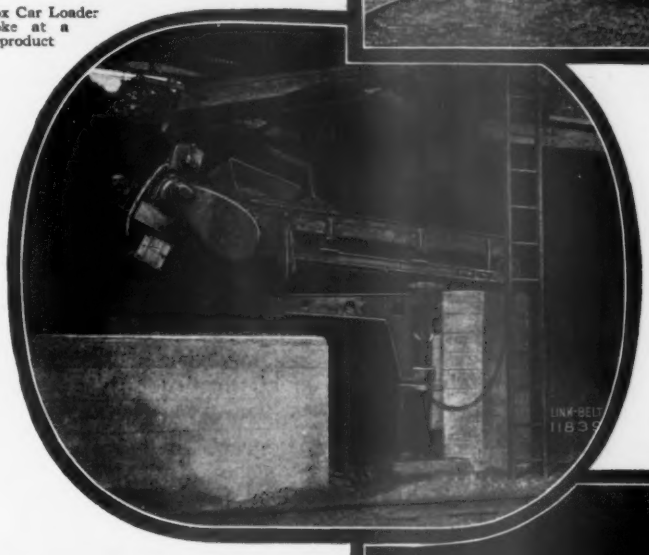

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In either case coal is loaded directly into the car without breakage.

Full information about either or both of these devices sent upon request.

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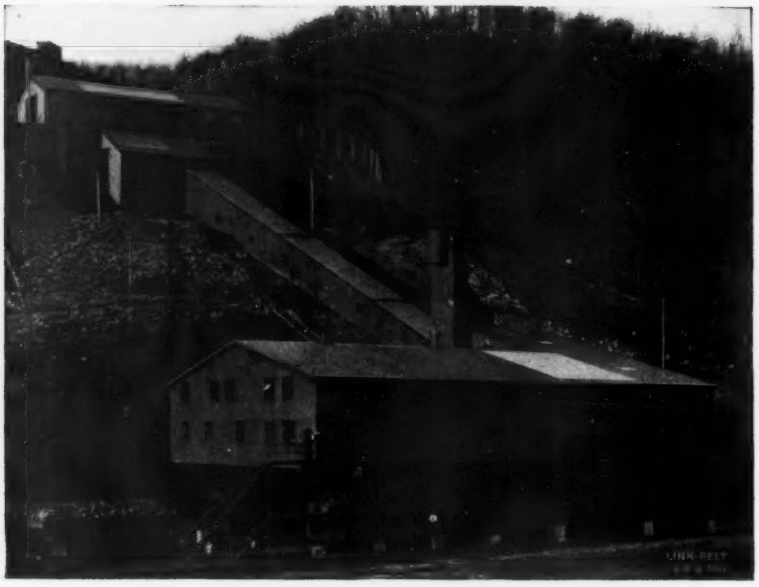

The Link-Belt Tipple of the Pocahontas Corporation, Amonate, Virginia, preparing coal loaded entirely by mechanical loaders; since the above photograph was made a Link-Belt Washery has been added.

IN THE last analysis there is just one thing you want to know about mine equipment—and that is—"what can it do—how long will it last"—in short, "performance."

The performance of Link-Belt Coal Preparing Plants in every coal field in the country has earned for us an enviable reputation as builders of successful plants which are reliable, durable and economical in operation.

All of the superior manufacturing facilities of our modern shops; the experience and skill of our designers and field engineers are combined to produce equipment which will, in each instance best meet the particular condition.

A brief outline of our experience is contained in Book No. 555; sent upon request to our nearest office.

Link-Belt Equipment for the Coal Mine

Coal Tipples	Screens	Boom Hoists	Vibrating Screens	Conveyors of Every Type
Coal Washeries	Retarding Conveyors	Locomotive Cranes	Face Conveyors	Chains, Wheels, Buckets
Loading Booms	Car Dumps, Car Hauls	Crawler Cranes	Spiral Separators	Silent Chain Drives
Picking Tables	Crushers	Portable Loaders	Manierre Box Car Loaders	Roller Chain Drives

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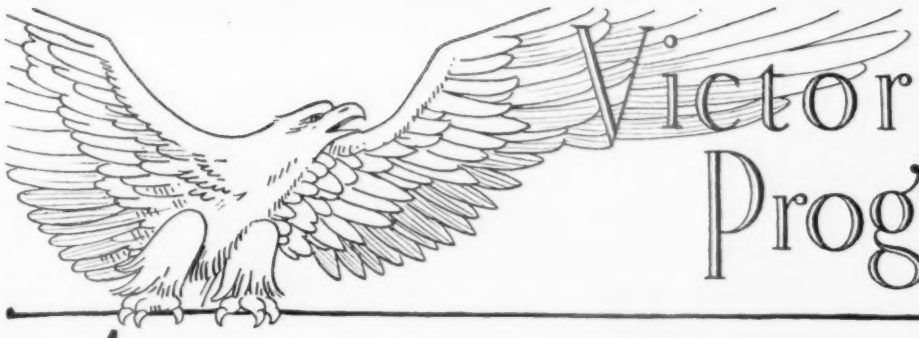
LINK-BELT

Coal Mining Machinery



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